FIELD INSTRUCTIONS

FOR THE

INVENTORY

OF

THE HAWAIIAN ISLANDS

2012

Forest Inventory and Analysis Program

Pacific Northwest Research Station

USDA Forest Service

THIS MANUAL IS BASED ON:

FOREST INVENTORY AND ANALYSIS

NATIONAL CORE FIELD GUIDE

FIELD DATA COLLECTION PROCEDURES FOR

PHASE 2 PLOTS VERSION 5.1

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1 INTRODUCTION

This manual documents the field procedures by the Forest Inventory and Analysis Program (FIA) in the inventory of the Pacific Islands.

FIA, a program within the Pacific Northwest Research Station (PNW), USDA Forest Service, is one of five Forest Inventory and Analysis work units across the United States. PNW-FIA is responsible for inventorying the forest resources of Alaska, California, Oregon, Washington, Hawaii, Guam, American Samoa, Republic of Palau, Federated States of Micronesia, Commonwealth of Northern Mariana Islands, and Marshall Islands.

A. Purposes of this manual

This manual serves two purposes, to:

- instruct field personnel in how to locate and measure field plots.
- document the field procedures, methods, and codes used in the inventory.

B. Organization of this manual

This manual is structured primarily for use by field personnel. Each chapter corresponds either to a separate function that must be performed in locating and measuring a field plot, or to a particular aspect of data recording that must be completed.

The procedures in this manual are ordered to coincide as much as possible with the order in which field data items are collected and entered into data recorders in the field, and the laptop data entry program. Some procedures and codes are repeated in multiple chapters of the manual to minimize the need to refer to additional chapters while collecting data in the standard order.

This manual incorporates the field data collection procedures of the Forest Inventory and Analysis National Core Field Guide with regionally specific procedures.

Information that is infrequently used or that is included only for documentation is in the appendices at the end of this manual. A glossary and an index are provided for quick reference.

**Text that is <u>underlined</u> is CORE text taken from version 5.1 of the National Core Field Guide. Shaded collection specifications below data items are also deemed CORE.*

<u>Each section of the field guide begins with a general overview of the data elements collected at that level and background necessary to prepare field crews for data collection. Descriptions of data elements follow in this format:</u>

DATA ELEMENT NAME -- <brief variable description>
When collected: <when data element is recorded>
Field width: <X digits>
Tolerance: <range of measurement that is acceptable>
MQO: <measurement quality objective>
Values: <legal values for coded variables>

Data elements, descriptions of when to collect the data elements, field width, tolerances, MQO's, and values, apply to both Phase 2 plots (formerly called FIA plots) and Phase 3 plots (formerly called FHM Detection Monitoring plots) unless specifically noted. Field width designates the number of columns (or spaces) needed to properly record the data element.

Tolerances may be stated in +/- terms or number of classes for ordered categorical data elements (e.g., +/- 2 classes); in absolute terms for some continuous variables (e.g., +/- 0.2 inches); or in terms of percent of the value of the data element (e.g., +/- 10 percent of the value). For some data elements, no errors are tolerated (e.g., PLOT NUMBER).

MQO's state the percentage of time when the collected data are required to be within tolerance. Percentage of time within tolerance is generally expressed as "at least X percent of the time," meaning that crews are expected to be within tolerance at least X percent of the time.

UNITS OF MEASURE
The field guide will use ENGLISH units as the measurement system.

PLOT DIMENSIONS:

Subplot - for selecting trees with diameters >= 5.0 inch (in)

Radius= 24.0 feet
Area = 1,809.56 square feet or approximately 0.04 acre or approximately 1/24 acre

Microplot - for counting seedlings and selecting saplings with diameters >= 1.0 inch (in)

Radius = 6.8 feet
Area = 145.27 square feet or approximately 0.003 acre or approximately 1/300 acre

The distance between subplot centers is 120.0 feet horizontal.
The minimum area needed to qualify as accessible forest land is 1.0 acre.
The minimum width to qualify as accessible forest land is 120.0 ft

Tree Limiting Dimensions:

breast height	4.5 ft
stump height	1.0 ft
merchantable top	4.0 in DOB
merchantable top for woodland	1.5 in DOB

minimum conifer seedling length	0.5 ft
minimum hardwood seedling length	1.0 ft
seedling/sapling DBH/DRC break	1.0 in DOB
sapling/tree DBH/DRC break	5.0 in DOB

1.1 GENERAL DESCRIPTION

The CORE field plot consists of four subplots approximately 1/24 acre in size with a radius of 24.0 feet. The center subplot is subplot 1. Subplots 2, 3, and 4 are located 120.0 feet horizontal (+/- 7 feet) at azimuths of 360, 120, and 240 degrees, respectively, from the center of subplot 1 (see Figure 1). Throughout this field guide, use of the word "plot" refers to the entire set of four subplots. "Plot center" is defined as the center of subplot 1.

Subplots are used to collect data on trees >= 5.0 inches.
Each subplot contains a microplot of approximately 1/300 acre in size with a radius of 6.8 feet. The center of the microplot is offset 90 degrees and 12.0 feet horizontal (+/- 1 foot) from each subplot center. Microplots are numbered in the same way as subplots. Microplots are used to select and collect data on saplings (DBH of 1.0 inch through 4.9 inches) and seedlings [DBH less than 1.0 inch in diameter and greater than 0.5 foot in length (conifers) or greater than 1.0 foot in length (hardwoods)].

Each unit may choose which Phase 3 indicators to collect as core optional on a Phase 2 plot that is not a Phase 3 plot. They may choose no indicators, all indicators or a subset. If they choose to collect data for a Phase 3 indicator, all the procedures for the indicator must be followed for that indicator to be considered core optional (data in National NIMS). If a subset of measurements for an indicator are collected, that is considered a regional enhancement and the data will be in the regional database.
Data are collected on field plots at the following levels:

Plot Data that describe the entire cluster of four subplots.

Subplot Data that describe a single subplot of a cluster.

Condition Class A discrete combination of landscape attributes that describe the environment on all or part of the plot. These attributes include CONDITION CLASS STATUS, RESERVED STATUS, OWNER GROUP, FOREST COMMUNITY, STAND SIZE CLASS, REGENERATION STATUS, and TREE DENSITY.

Boundary An approximate description of the demarcation line between two condition classes that occur on a single subplot or microplot. There is no boundary recorded when the demarcation occurs beyond the fixed radius plots.

Tree Data describing saplings with a diameter 1.0 inch through 4.9 inches, and trees with diameter greater than or equal to 5.0 inches

Seedling Data describing trees with a diameter less than 1.0 inch and greater than or equal to 0.5 foot in length (conifers) or greater than or equal to 1.0 foot in length (hardwoods).

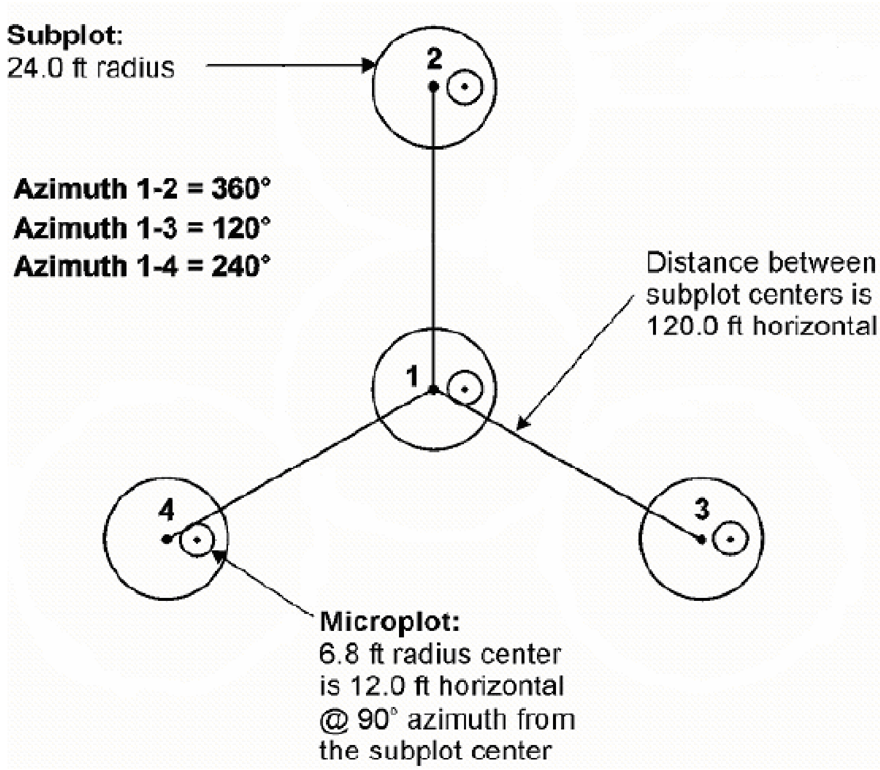


Figure 1. FIA Phase 2 plot diagram

1.2 PLOT SETUP

Plots will be established according to the regional guidelines of each FIA unit. When the crew cannot occupy the plot center because safety hazards exist, or the plot center is inaccessible or out of the sample, the crew should check the other subplots. If any subplot centers can be occupied and are in the sample, the subplots that can be occupied should be established and sampled following normal procedures. When a subplot center or microplot center cannot be occupied, no data will be collected from that subplot or microplot; instead, the entire subplot or microplot should be classified according to the condition preventing occupancy.

The following table provided can assist in locating subplot 2-4 from a subplot other than subplot 1.

Subplot From	Numbers To	Azimuth *degrees*	Backsight *degrees*	Distance *feet*
2	3	150	330	207.8
2	4	210	030	207.8
3	4	270	090	207.8

If a subplot was installed incorrectly at the previous visit, the current crew should remeasure the subplot in its present location and contact the field supervisor. In cases where individual subplots are lost (cannot be relocated), use the following procedures:

Assign the appropriate present CONDITION CLASS STATUS Code(s) to the new subplot (usually CONDITION CLASS STATUS = 1 or 2)

Assign TREE STATUS = 0 to all downloaded trees (i.e., incorrectly tallied at the previous survey).

Assign RECONCILE codes 3 or 4 (i.e., missed live or missed dead) to all trees on the new subplot.

Assign the next TREE RECORD NUMBER.

1.3 PLOT INTEGRITY

Each FIA unit is responsible for minimizing damage to current or prospective sample trees and for specifying how these trees are monumented for remeasurement. The following field procedures are permitted:

Scribing and nailing tags on witness trees so that subplot centers can be relocated.

Boring trees for age on subplots and annular plots to determine tree age, site index, stand age, or for other reasons.

Nailing and tagging trees on microplots and subplots so that these trees can be identified and relocated efficiently and positively at times of remeasurement.

Nailing, scribing, or painting microplot and subplot trees so that the point of diameter measurement can be accurately relocated and remeasured.

All other potentially damaging procedures that may erode subplot integrity are prohibited.
The following practices are specifically prohibited:

Boring and scribing some specific tree species that are known to be negatively affected (i.e., the initiation of infection or callusing).

Chopping vines from tally trees. When possible, vines should be pried off trunks to enable accurate measurement. If this is not possible, alternative tools (calipers, biltmore sticks) should be used.

Products
PNW-FIA provides information needed by resource planners, policy analysts, and others involved in forest resource decision-making. Data collected in PNW-FIA inventories is summarized, interpreted,

analyzed, and published in statistical and analytical reports of national, state, and subregional scope. PNW-FIA publishes information on area by forest land and owner classes, land use change; timber volume, growth, mortality, and removals; potential forest productivity; opportunities for silvicultural treatment; and kind and area of wildlife habitats. PNW-FIA also provides data to answer questions about forest resources.

Research topics

The data collected in these inventories represent a wealth of information for both applied and basic questions concerning forest ecosystems. Topics include: the distribution of plant species and their relationship to environment, the incidence of insects and disease in relation to FOREST COMMUNITY/community and condition, changes in forest due to disturbance, and improved prediction of forest growth and development on different sites and in response to management.

2 TRAVEL PLANNING AND LOCATING THE PLOT

A. Landowner contact

Permission
Written or verbal landowner permission must be obtained before a plot is visited. This responsibility lies with the field coordinator who may delegate contacting the landowner to the field crew.

Recording conversations with landowners
Include a record of each conversation with a plot landowner on the Ownership Contact form. While not a part of the official plot record, this information will document that permission was obtained, assist in accessing the area for variance-plots, and possibly aid the field crew during a future inventory.

Ask landowners if they can confirm the dates of any treatments or disturbances (usually harvesting) on the plot since the previous visit; record this date on the Plot Card and in Condition Class Data if requirements are met. Record any special circumstances about plot accessibility--such as locked gates or washed-out roads on the Plot Card.

Data requests
Plot specific data is released only to the legal owner of the plot area. Requests for photocopies of the field data sheets, Plot card, summarized plot data, and for copies of future publications based on information collected in this inventory should be noted on the Plot Card and recorded with LANDOWNER PLOT SUMMARY REQUEST in the data recorder. Current plot data will generally be sent to the owner after the field season is completed and plots are returned to the office. If the landowner desires, the crew may provide photocopies of plot data immediately after collection.

Any additional data requests should be referred to the client request person in the Anchorage office:

Ray Koleser		
Anchorage Forestry Sciences Lab	phone:	(907) 748-9416
3301 C Street		
Suite 200	email:	rkoleser@fs.fed.us
Anchorage, AK 99503		

B. Before leaving base camp

1. Make sure the landowner has been contacted (see above).
2. Plan the route to the plot. Always bring two or more extra plots.
3. Leave word of plot locations and expected destinations with the crew coordinator using the arranged system (cell phone, voice mail, etc).
4. Make sure your vehicle has all of the necessary field gear and a plot map.
5. Be in agreement with your crew partner(s) on a work procedure.
6. Inspect vehicle for fuel, oil, lights, safety features, and plot supplies (stakes, tags, pins, and nails) prior to departure.

C. Checklist of items needed on plot

Data recording items
Previous plot records and photos
Plot jacket (previous and current plot records with subplot diagrams, and field photos)
Hand-held data recorder downloaded with plot records; extra AA batteries
Handheld GPS unit with fully-charged batteries (bring extra batteries)
Survey Grade GPS unit (if needed on that plot for the day)
Mechanical pencils, red photo pen, black pen, eraser
Note pad(s) made of "write-in-the-rain" paper
Blank forms for plot, subplot, condition class attributes; tree tally; veg profile; and subplot diagram
Calculator(s)
Tatum
Field procedures manual
Plant ID guide(s), plant association guides, plant disease guide

Photo interpretation items
Plot (road) map
Stereoscope(s) (2x and/or 4x) with case and sharp straight pins
Photo scale (Timber Survey Aid #16)
6 inch ruler calibrated in 1/20th inches
Hand lens

Plot measuring items
Compass (es)
Clinometer(s)
Diameter tape(s)-20 foot
Increment borer(s) with sheath
100 foot tape(s) with carabineer(s)
Hand axe(s) with sheath
Laser height/rangefinder
Plant press or plastic bags for plant specimens

Plot referencing items
Steel plot pins
Aluminum nails
Tree number tags
Square aluminum tags
Round aluminum tags
Flagging tape

First aid items
First aid kits
Bee sting kits

Personal and safety gear
Canteens with water
Lunches
Utility pouch

Vest and hardhat
Rain gear
Gloves
Flashlight and batteries
Extra clothing
Extra food
Iodine tablets
Headlamps

Camping gear when applicable:
Tarps
Extra water or water purifier
Stove with fuel and matches
Food
Cooking/eating dishes
Flashlight

D. Safety

Personnel working in the field are subject to many safety hazards. Each person must always be conscious of these hazards to avoid accidents:

1. **Don't take chances!**
2. **Eliminate horseplay and carelessness!**
3. **Think safety!**
4. **No task is more important than personal safety!**
5. **Always make sure that someone else knows where you plan to work each day!**

Safety in the woods

Wear protective clothing: Long-sleeved shirts, long pants, and gloves may protect you from contact with brush, rocks/coral and stinging/biting insects. Trouser legs should be loose enough to avoid binding or cramping, and should not have cuffs. Wear a hardhat at all times in the woods.

Wear good quality boots that provide good support and traction. For example: 8-inch high leather work boots with lug-soles (Vibram-type soles).

Walk, don't run in the woods. Take your time and plan your route. Avoid plunging through the brush. The best route of travel may not be the shortest. Routes across brushy, irregular terrain with rocks and down logs can be hazardous.

Be watchful of twigs and branches, which may cause eye injury. Be especially alert when stepping up to trees which retain their small dead twigs. Keep a sufficient distance between you and the person ahead of you to avoid being slapped by branches.

Lift knees high to clear obstacles in heavy undergrowth or slash. Slow down and watch your step.

When contouring a steep slope, do not lean into the hill. This tends to loosen footing. Erect posture or slightly leaning out gives more secure footing.

Know how to fall to avoid hard impacts. Keep flexible with knees slightly bent. If you feel yourself slipping, pick a landing spot. Do not stick your arms out to break a fall. Roll with the fall. Try to take the impact on the side of your body rather than your back.

Don't take chances by walking across ravines on small logs.

Bee aware. Keep an eye out for yellow jacket and hornet activity. Yellow jackets nest in the ground, often in well-decayed logs or in thick moss on trees or in snag cavities. Yellow jackets are particularly active (nasty) during late summer and early fall when forest conditions are very dry. Hornets nest above ground in "paper" nests that are suspended from branches; woe befalls those who unwittingly bump their head against a nest, or shake the sapling from which a nest is suspended. If allergic to insect stings, carry medication to counteract the effects of stings.

Avoid poisonous plants/animals, if possible. After contact with toxins, remove clothes carefully, wash exposed areas with cool, soapy water, and wash clothes before wearing them again.

Keep someone posted as to where you plan to work each day, particularly on long hikes into the forest, so that if you do not return in a reasonable time, someone can find you.

Keep hatchets in their sheath except when actually using them, and snap the sheath shut.

First Aid. Keep your individual first-aid kit completely supplied, and know how to use it. Treat all wounds promptly.

Carry matches and possibly a small flashlight. On very long hikes, take extra food, clothing, and matches in case you are caught out in the woods at night. Never build fires in forest duff or leave a campfire until it is dead out.

Check for ticks. The beasties bite and can carry Lyme disease. (not usually encountered in HI)

Carry plenty of water. Don't expect your partner to carry water for you.

Beware of lightning. Watch for approaching storms. Avoid prominent high exposed ground and tall/lone trees. Abandon field gear, especially that which is made of metal. Seek shelter in the vehicle if possible, otherwise in thick timber, large caves or in valley bottoms. Crouch on the balls of your feet with your head covered. Separate 100 feet from other crew members.

Safety on the road
It all pays the same, so drive with care, with courtesy, regardless of others' actions, and with common sense. Follow these tips:

Seat belt use is required by all government employees, volunteers, and contractors. Do not ride in the back of pickups.

DRIVE DEFENSIVELY! Expect the other person, whether a vehicle operator or a pedestrian, to do the worst thing and be prepared. Observe all speed regulations and traffic signs.

Do not drive when sleepy, taking medication, or when other personal conditions make it unsafe to drive a vehicle. Get someone else to drive or, if alone, stop driving and nap (out of the public view).

Always drive with your headlights on. This practice increases the visibility of your vehicle. It is particularly important when driving in fog, on dusty roads, traveling in and out of shadows, and any other low light/visibility situations. Turn lights off when you park the vehicle.

Do not operate a vehicle in an unsafe condition. Check your vehicle frequently to keep it in good mechanical condition. Lights, horn, steering, and brakes should be kept in proper adjustment at all times. Make necessary repairs as soon as unsafe condition develops. Report any unsafe conditions to your supervisor.

Keep the vehicle clean. Windows, mirrors, and lights should be kept clean and free of obstructions to increase visibility. Keep the cab and driver area clean so material is not rolling under pedals or distracting the driver.

Shift to a lower gear at the beginning of a grade, if the grade is a long, steep descent.

Adjust vehicle speed to the driving conditions. Wet, icy, or snowy roads and decreased visibility require decreased speed. Be aware of speed when changing from one type of road to another, i.e., Freeway to secondary highway to gravel and adjust speed accordingly.

Don't tailgate. Allow at least three seconds of travel distance between yourself and the vehicle ahead. Under slippery road conditions and poor visibility, allow more distance.

Be aware of your vehicle's idiosyncrasies and adjust your driving accordingly.

Be alert for heavily loaded trucks moving at high speeds when driving on privately-owned log-haul roads. Observe all traffic control signs, particularly signs requiring you to drive on the left side of the road.

Back up safely. Walk around your vehicle to check for hazards before backing and use a spotter to guide you.

Do not drive and navigate at the same time. If the driver needs to look at maps and photos, stop at a safe place, then look at them.

Watch for animals on the road. Most hoofed animals travel in groups, so where there is one, assume there are many, with all just itching to jump out in front of your vehicle. Stop and let the animal move off the road, look for others to follow, then proceed on. If you cannot stop in time to avoid hitting an animal, it is generally better to hit it, than to go off the road or hit another vehicle.

Park the vehicle so that it is not a hazard to other drivers. Do not park where dry grass or other potential fuels can come in contact with your vehicle's hot exhaust system.

Keep as far right as is safely possible on blind curves on logging roads. If the curve is blind and less than two lanes wide, slow way down and be ready to take evasive action.

Yield to uphill vehicles on roads wide enough only for one vehicle.

What to do if injured:

Treat the injury promptly. If immediate medical attention is required, go directly to a hospital emergency room. Try to make contact with your supervisor or the office to get instructions and assistance. Make sure the doctor fills out his/her part on the CA-1 form.

Inform your supervisor of all injuries and ask which, if any, forms need to be filled out. Supervisors must inform the office at the earliest opportunity.

Fill out Federal accident forms completely with signatures. ALWAYS make a copy for your personal records. Give the completed forms to your supervisor. Have the supervisor check your entries for mistakes, fill out their section, and forward the completed forms to the appropriate person.

Gather Information. If you are in a multi-vehicle accident, provide the other parties with enough written information so that they can easily get in touch with you, your crew supervisor, and the office. In turn, you must get the following information from all involved parties and witnesses -- names, addresses, phone numbers, vehicle license numbers, driver's license numbers, insurance company names and policy numbers, and police report numbers. If possible, do not admit responsibility without first contacting your supervisor.

E. Plot location aids

Each field crew should have a road map with the location of the plots marked and a plot packet for each plot you may visit. The plot packet for each field plot will generally contain old and new photos, previous plot records with plot diagrams, current computer-printed Plot, Subplot, and Condition Class Attribute records, computer-printed current tree tally records, and a plot review sheet.

Use the road map, plot cards and aerial photos from the previous inventories to locate the plot. The county, plot number, and legal description (township, range, section, and forty) are printed on the Plot Attribute record. Plot locations are marked and numbered on the road map. Use the road map to reach the general vicinity of the plot by motor vehicle. Once you are within the area covered by the photos, you may use the photos to find the exact plot location on the ground.

Plots not previously visited

These plots will have new aerial photos with the field grid location pinpricked on them. Some plots may also have coordinates obtained by digitizing USGS topographic maps or by some other means.

F. Locating the plot on the ground

Locating new plots

1. Locating a plot by inspection: For plots not previously established (i.e. plots without field photos that were pinpricked at the time of previous inventory), use the new photos to proceed to the pinpricked location by photo interpretation. When you reach the point you believe is the pinpricked location, carefully check the pinpricked field grid location on the new photos against the surrounding terrain and pattern of tree crowns and vegetation to confirm that the pinpricked location on the photo and your location on the ground are exactly the same spot. In some cases you may be able to navigate to the plot center using the GPS receiver then pinprick the aerial photograph after confirming your location as described above.

2. Locating a plot with an RP (The reference point, see page 29) and baseline: You may encounter a plot that is difficult to locate using photo interpretation. In this case you may establish a baseline on the photos to determine true photo azimuth and scale. Once the baseline is established:
   a) Select, tag, pinprick, and record a RP, preferably within 500 feet of the plot. (See: The reference point, page 28).
   b) On the photos, draw a straight line between the RP and pinpricked location.
   c) Determine the azimuth and distance from the RP to the referenced subplot.
   d) Measure out the calculated azimuth and distance to the referenced subplot. Locate the field grid location which is the center of subplot 1 on the standard layout to begin the plot. If a new plot, carefully check the photos against the surrounding terrain and vegetation to make sure you are actually at the field grid location pinpricked on the new photo.

G. Plots with active logging

If the plot area is being logged (timber is being felled, bucked, or yarded) or is unsafe to visit because of active logging, DO NOT ESTABLISH THE PLOT. Note on the plot jacket the status of the logging operation and return the plot to the supervisor. The supervisor will hold the plot until later in the season, when the status of the logging operation will be checked again to see if the plot can be completed.

H. Denied access plots

If access is denied to the field grid location or a portion of a plot, see "Noncensus Water, Census Water, Nonsampled" on page 27.

I. Plot location Tolerance

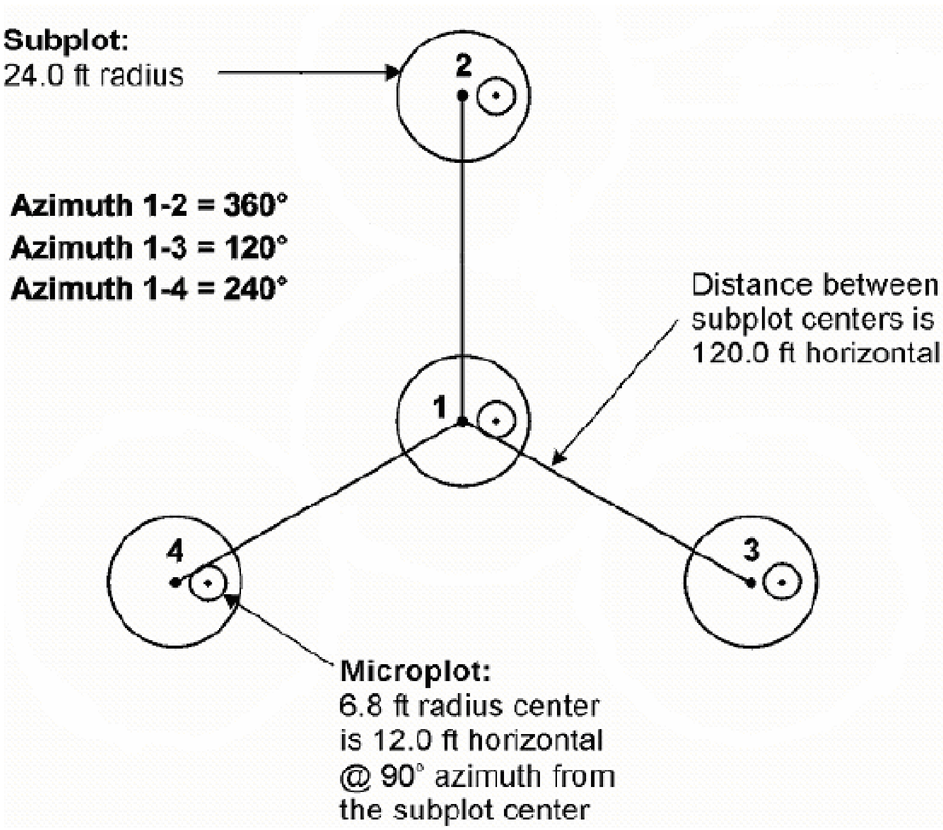
Plot location
Tolerance: Remeasured plot: N/A – plot is relocated
New plot: located +/- 30.0 ft.
Aerial photograph
Tolerance: Previous and current pinpricks in correct spot: +/- 1 mm. 100% of the time

3 PLOT LAYOUT AND REFERENCING

A. Plot layout at the current annual inventory

In the current annual inventory the 4 subplots are laid out in the pattern below across condition classes. Subplots are **never** "substituted" or "moved" in order to keep the entire subplot within a condition class.

Standard 4-subplot plot diagram



The following table can assist in locating subplots *2 through 4* from a subplot other than subplot 1

Subplot Numbers		Azimuth	Backsight	Distance
From	To	Degrees		Feet
2	3	150	330	207.8
2	4	210	030	207.8
3	4	270	090	207.8

B. Noncensus water, Census water, Nonsampled

At the current inventory for all subplots (including subplot 1 - plot center)

1. If a subplot center lands in accessible forest land or accessible nonforest land, then any Noncensus water, Census water, or Nonsampled (Denied Access, Hazardous, etc) condition classes are mapped as separate condition classes. Measurements are taken only in any

accessible forest land condition classes and accessible nonforest condition classes when nonforest is being sampled.
2. If a subplot center lands in Noncensus water, Census water, or Nonsampled areas (Denied access, Hazardous, etc), the subplot will not be installed or referenced. The entire subplot is classified as the subplot center condition, even though a portion of it may be in another condition class. Other subplots are installed using normal procedures.

See Condition Class on page 55 for further instructions.

C. Recognition of condition classes

Each plot area recognized within an inventoried area is divided into condition classes. The area within each subplot's 24.0 foot fixed-radius is mapped using these condition classes. Condition classes are first defined by differences in condition status. Some of these condition classes may be further subdivided by other attributes. The condition class in which the field grid location lies (the center of subplot 1) is always condition class 1. While most subplots encompass only one condition class, some will have two or more classes within their 24.0 foot radius.

Condition classes are determined in three steps:
1. Plot area is divided into condition classes based on differences in condition status.
2. Accessible forest land condition classes are further divided by differences in 6 mapping variables.
3. Nonforest land condition classes are further divided, in some cases, by differences in nonforest land use.

See the Condition Class chapter on page 55 for complete instructions.

D. Subplot numbering

Install 4 subplots

Install the four subplots in the configuration described above. The subplots are labeled #1, #2, #3, and #4.

All condition classes present on the subplot (within the 24 ft. fixed radius) are mapped on the plot diagram. In accessible forest land and measured nonforest condition classes, trees, snags, saplings, seedlings, and understory vegetation are measured. These data are not measured or collected in any other type of mapped condition classes.

E. Referencing the plot

1. Referencing plots not visited previously

If the plot has not been visited previously, the field grid location was pinpricked on the new field photos prior to field visit. The pinprick is marked on the photos with a nearby red dot.

Do the following steps:

a) Find this pinpricked field grid location on the ground. (The location will become the center of subplot 1 on the standard layout).
b) Install a center pin at this location on the ground. Check to see that "An exception" listed below does not apply.
c) Reference the new stake to nearby two trees; see "Referencing the center pin" on page 30.

d) Reference the new stake to an RP; see "The reference point (RP)" below.
e) Circle the pinprick in pencil on the back of the photo and write "PC" (plot center) and the plot number near the circle.
f) Determine and pinprick the ground location of the RP on the new photos using photo interpretation. Circle the pinprick in pencil on the back of the photo and write "RP" near the circle.

2. An exception

The center pin is not placed at the field grid location of subplot 1 if either of the following situations occur:

a) the center of subplot 1 is too hazardous to visit (examples: subplot center 1 is in the middle of a pond, or the middle of a freeway, or on the side of a cliff) **OR**
b) placing the center pin at the center of subplot 1 is very apt to irritate a landowner (example: subplot center 1 is in the middle of someone's front lawn).

If the exception applies, reference the center of the lowest-numbered subplot on the standard layout on which the above exceptions do not apply. *Record and electronic PLOT NOTE stating which subplot was monumented with the center pin.*

Specifically, do the following steps:

a) Place a center pin at the center of this subplot,
b) Reference the new stake to two nearby trees; see "Referencing the center pin" on page 30.
c) Reference the new stake to an RP; see "The reference point (RP)" below.
d) If a revisited plot, <u>determine and pinprick the location of the field grid location</u> on the new photos using photo interpretation. All plots: use a photo marking pen to circle the pinprick on the back of the photo and write "PC" (plot center) and the plot number near the circle.
e) Determine and pinprick the ground location of the RP on the new photos using photo interpretation. Circle the pinprick in pencil on the back of the photo and write "RP to subplot (insert number)" near the circle (Example: "RP to subplot 3"). Also write RP Data on the back of the photo including: species, diameter, azimuth, horizontal distance, and the subplot number referenced.

Keep in mind that the field grid location in this case, is <u>not</u> at the location of the center pin. The field grid location is always the center of subplot 1 on the standard layout regardless of whether it is referenced.

3. The reference point (RP)

The RP references the center pin. It is an object (usually a tree) that is prominent, apt to be present at next visit and easily located on the ground.

<u>**Selecting an RP:**</u> The RP should be distinctive on both the ground and on the new photos. You may reuse an old RP tree on a previously measured plot if it is suitable. If the old RP tree is dead, missing, or difficult to identify on the ground or on the plot photo, select a new RP. If possible, it should be a tree which is not likely to die or be cut before the next inventory. You may select a snag or other object for an RP (i.e., a distinctive fence post, building corner, telephone pole, etc.). If you use such a RP, describe it on the plot photo and in "Location Description" on the Plot Card.

<u>Tag the RP:</u> *Special Note: Do not affix the lower square tag on lands owned by the Division of Forestry and Wildlife (DOFAW). Upper tags should still be affixed to the RP 6 feet or higher. Two tags should be affixed facing the direction of approach and one tag facing the direction to plot.

Mark the RP tree with new or reused tags. Nail aluminum square tags on two or more sides of the RP tree, 6 feet above ground line, facing directions you expect future crews to approach the RP. Also nail an aluminum square tag on the RP tree below stump height, on the side of the tree facing the center pin. When attaching a tag, drive the nail into the tree only enough to anchor the nail firmly into the wood; always leave at least 2 inches of nail exposed. **<u>Pinprick the RP location:</u>** Pinprick the ground location of the RP on the new photos UNLESS the RP pinprick would obscure another pinprick. Circle the RP pinprick on the back of the photo and write "RP" and the plot number near the circle (but do not obscure any pinpricks).

<u>Record RP data:</u> Record the species of the RP, it's d.b.h. to the nearest inch, azimuth from RP to center pin, and horizontal distance measured to the nearest foot from RP to the center pin on the back of the aerial photo, under "RP Data" on the Plot Card, and in the Data Recorder.

In "Plot Access Description" on the Plot Card, record any information that would aid the next crew in relocating the plot. Describe prominent features present in the plot area that are unlikely to change in the next ten years; examples include details such as slope, aspect, topographic position, recognizable physiographic features (i.e. streams, rock outcrops, benches), human-made features, and unusual or large trees. If any new roads have been built in the plot area since the date of the new field photos, sketch them on the photos if it will help the next crew to find the plot.

Example: "The RP is a large Ohia-fir (over 50 feet tall) in a draw that descends northeast from mainline logging road 1000. Subplot 1 is down slope from the RP and is just down slope and next to a large rock outcrop."

4. Referencing the center pin

***Special Note: Do not affix the lower reference tags or nails to reference trees on lands owned by the Division of Forestry and Wildlife (DOFAW). This is a special case request. The upper tags should still be installed.**

To reference the center pin with nearby trees, **do the following steps:**

A) Select two trees near the center pin that form, as closely as possible, a right angle with the stake. If the previous reference trees meet this criterion, reuse them. On a revisited plot, if you select a new reference tree, remove the square tags (if present) from the reference tree it is replacing to avoid confusing the next crew. Trees within 6 feet of the stake are preferable. If live trees are not available, use stumps or sound snags.
B) Nail a square (silver) aluminum tag well below stump height (< 0.5 feet above ground level) on each witness tree on the side facing plot center.
C) At two locations on each witness tree, nail a square aluminum tag six feet above ground height facing the direction of expected approach to plot.

D) If the references for the center pin are stumps, shrubs, or other objects, follow the procedures listed below for witnessing other subplots with the following exception: use the square (silver) aluminum tags instead of the yellow round tags.
E) Record data about the witness trees in the Data Recorder; refer to "Recording witness tree data" on page 32.

F. Referencing the other subplots on the standard layout

***Special Note: Do not affix the lower reference tags or nails to reference trees on lands owned by the Division of Forestry and Wildlife (DOFAW). This is a special case request. The upper tags should still be installed 6 feet or higher.**

One subplot on the standard layout, usually subplot 1, is referenced adequately by the center pin and its nearby witness trees and RP. Do the following steps:

1. Mark subplot center.
Mark subplot center with a metal pin and round, and tie a piece of flagging to the pin.

2. Select witness trees.
Select 2 trees near the pin that form, as closely as possible, a right angle with the pin. Trees within 6 feet of the pin are preferred. If trees are not available, use stumps or sound snags. On subplots established previously, reuse the previous witness trees, or if there are better trees available, use new witness trees. Renew old witness tags as needed.

3. Tag the reference trees.

A) **If the witness is a live tally tree ≥3.0 inches DBH**: attach one or two yellow round aluminum tag(s) six feet above ground height facing the direction of anticipated approach to the subplot. Note: avoid using tally saplings unless no other trees are available. If saplings must be used, place the yellow round aluminum tag behind the number tag and wire them to an ancillary branch.
B) **If the witness is a dead tally tree**: attach one or two yellow round aluminum tag(s) six feet above ground height facing the direction of anticipated approach to the subplot. Pound nails flush with the bole of the snag.
C) **If a witness is a non-tally tree**: attach one yellow round aluminum tag below stump height facing subplot center, and one or two yellow round aluminum tag(s) six feet above ground height facing the direction of anticipated approach to the subplot. If the witness is a live tree ≥3.0 inches DBH, attach an aluminum nail at the diameter measurement point. If saplings must be used, wire the yellow round aluminum tag to an ancillary branch facing subplot center.
D) **If the witness is a stump (i.e., < 4.5 feet tall)**: attach a yellow round aluminum tag below stump height facing plot center. Attach another yellow round aluminum tag centered on the top/cut face of the stump. When nailing tags to stumps, pound nails flush to the bole. Tags nailed to stumps stay attached longer if bark is removed prior to nailing the tag.
E) **If the witness is a shrub**: nail or wire a yellow round aluminum tag to the base of the shrub facing subplot center. If possible, nail or wire an additional round higher in the shrub facing the direction of expected approach to the subplot.

F) **If the witness is another object**: monument as appropriate for the object. Record any important information in the records notes (in the data recorder).

4. Record data about the witness trees
Refer to "Recording witness tree data" (next section).

G. Recording witness tree data (all subplots on the standard layout)

***Special Note: Lands owned by the Division of Forestry and Wildlife (DOFAW) and national parks where lower tags cannot be attached: Record the slope distance from the base of the subplot (at center) to the front of the tree/object at the base in the data recorder.**

Azimuth (subplot center to tree), slope distance to the head of the nail affixing the basal tag or tree number tag, species, and diameter are recorded for each witness tree, snag, or stump. Other witness objects only require an azimuth, slope distance, and a record note to describe the object. NOTE: Witness tree distance is always slope distance from the subplot center to the head of the nail affixing the basal aluminum tag or tree number tag. This is in addition to the horizontal distance to the center of the tree collected for all tally trees. Record this information in the data recorder.

H. Plot layout and referencing MQO

RP selection
Tolerance: No error in selection criteria

Subplot location
Tolerance: Remeasured subplot: +/- 0.5 ft. of previous location
New subplot: +/- 5.0 ft.
Subplot witness (tree) selection
Tolerance: No error in selection criteria

4 PLOT LEVEL DATA

All variables listed in this chapter are collected on plots with at least one accessible forest land condition (PLOT STATUS = 1) and all NONFOREST/NONSAMPLED plots (PLOT STATUS = 2 or PLOT STATUS = 3). In general, plot level data apply to the entire plot and they are recorded from the center of subplot 1. A plot is considered nonforest if no part of it is currently located in forest land (CONDITION CLASS STATUS = 1). A plot is nonsampled if the entire plot is not sampled for one of the reasons listed in PLOT NONSAMPLED REASON.

If a forest plot has been converted to nonforest or becomes a nonsampled plot, the previous data are reconciled and an attempt is made to visit the plot during the next inventory. If a nonforest plot becomes forest or access is gained to a previously nonsampled plot, a new forest ground plot is installed. All nonforest and nonsampled plots are visited if there is any reasonable chance that they might include some forest land condition class.

Trees on previously forest land plots will be reconciled during data processing. There is a distinction between plots that have been clearcut, and plots that have been converted to another land use. A clearcut plot is considered to be forest land until it is actively converted to another land use.

4.1 STATE (CORE 1.1) [STATECD]

Downloaded unique FIPS (Federal Information Processing Standard) code identifying the State where the plot center is located.

When collected: All plots
Field width: 2 digits
Tolerance: No errors
MQO: At least 99% of the time
Values: 15 (HAWAII)

4.2 ISLAND (HAWAII) [PAC_ISLAND_PNWRS]

Downloaded name identifying the island the plot is located on. This should also be printed on the Plot Jacket

When collected: All plots
Field width: 20 characters
Tolerance: No errors
MQO: At least 99% of the time
Values: HAWAII, KAHOOLAWE, KAUAI, LANAI, MAUI, MOLOKAI, NIIHAU, OAHU

4.3 COUNTY (CORE 1.2) [COUNTYCD]

Downloaded unique FIPS (Federal Information Processing Standard) code identifying the county, parish or borough where the plot center is located.

When collected: All plots
Field width: 3 digits
Tolerance: No errors
MQO: At least 99% of the time
Values:

001 Hawaii (ISLAND - HAWAII)
003 Honolulu (ISLAND - OAHU)
005 Kalawao (ISLAND - MOLOKAI – not the COUNTY)
007 Kauai (ISLANDS - KAUAI and NIIHAU)
009 Maui (ISLANDS – MAUI, KAHOOLAWE, LANAI, and most of MOLOKAI)

4.4 PLOT NUMBER (CORE1.3) [PLOT]

Record the identification number for each plot, unique within a county, provincial unit or island.

When collected: All Plots
Field width: 5 digits
Tolerance: No errors
MQO: At least 99% of the time
Values: 00001 to 99999

4.5 FIELD GUIDE VERSION (CORE 1.12 [MANUAL]

Record the version number of the National Core Field Guide that was used to collect the data on this plot. FIELD GUIDE VERSION will be used to match collected data to the proper version of the field guide.

When collected: All plots
Field width: 2 digits (x.y)
Tolerance: No errors
MQO: At least 99% of the time
Values: 5.1

4.6 VEGETATION/INVASIVE SAMPLING

4.6.1 P2 VEGETATION SAMPLING STATUS (CORE OPTIONAL 8.3.1) [P2VEG_SAMPLING_STATUS_CD]

This plot-level variable determines whether vegetation data will be recorded on the plot and the land class(es) on which it will be recorded. If P2 VEGETATION SAMPLING STATUS = 0, no further P2 Vegetation data collection is required.

When collected: All plots
Field width: 1 digit
MQO: No errors
Tolerances: At least 99% of the time

Values:

- 0 Not sampling vegetation
- 1 Vegetation data collected only on accessible forest land conditions (CONDITION CLASS STATUS = 1 and NONFOREST SAMPLING STATUS = 0)
- 2 Vegetation data collected on all accessible land conditions (CONDITION CLASS STATUS=1 or 2, NONFOREST SAMPLING STATUS =1 and NONFOREST PLOT STATUS=1)

4.6.2 LEVEL OF DETAIL (CORE OPTIONAL 8.3.2) [P2VEG_SAMPLING_LEVEL_DETAIL_CD]

This plot-level variable determines whether data are collected for vegetation structure growth habits only or for individual species (that qualify as most abundant) as well. If LEVEL OF DETAIL = 3, then a tree species could be recorded twice, but it would have two different species growth habits (see 8.5.1 SPECIES GROWTH HABIT). **The Hawaii inventory will be downloaded with code “2”.**

When collected: on all plots where P2 vegetation is being sampled (P2 VEGETATION SAMPLING STATUS = 1 or 2)
Field width: 1 digit
MQO: No errors
Tolerances: At least 99% of the time
Values:

- 1 Collect data for vegetation structure only; total aerial cover and cover by layer for tally tree species (all sizes), non-tally tree species (all sizes), shrubs, forbs, and graminoids.
- 2 Collect vegetation structure data (Level of Detail = 1) **plus** understory species composition data including up to four species of: seedlings and saplings of any tree species (tally or non-tally) <5 inches DBH (DRC for woodland species), shrubs (including woody vines), forbs, and grasses.
- 3 Collect vegetation structure data, understory species composition data (Level of Detail = 2), **plus** up to four trees species (tally or non-tally) ≥5 inches DBH (DRC for woodland species)

4.6.3 INVASIVE PLANT SAMPLING STATUS (CORE OPTIONAL 9.3) [INVASIVE_SAMPLING_STATUS_CD]

Determines whether invasive plant data will be recorded on the plot and the land class(es) on which it will be recorded. **For most of Hawaii (with the exception of Experimental Forest Land), this data item will be downloaded with code “1”.**

When collected: All plots
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values:

- 0 Not collecting invasive plant data
- 1 Invasive plant data collected only on accessible forest land conditions (CONDITION CLASS STATUS = 1)
- 2 Invasive plant data collected on all accessible land conditions (CONDITION CLASS STATUS =1 OR NONFOREST CONDITION STATUS=2)

4.6.4 INVASIVE PLANT SPECIMEN COLLECTION RULE (CORE OPTIONAL 9.12) [INVASIVE_SPECIMEN_RULE_CD]

Downloaded code to indicate if collection of specimens of unknown (or suspected) invasive species is required. **The Hawaii inventory will be downloaded with code "0" for this data item.**

When collected: Downloaded on all plots where INVASIVE PLANT SAMPLING STATUS = 1 or 2
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values:

0	FIA unit does not require specimen collection for invasive plants
1	FIA unit requires specimen collection for invasive plants

4.7 SURVEY GRADE GPS COORDINATES COLLECTED (HAWAII) [GPS_SAMPLING_STATUS_CD_PNWRS]

Downloaded code identifying whether or not Survey Grade GPS Coordinate information should be collected on plot.

When collected: All plots
Field Width: 1 digit
Tolerance: No errors
MQO: N/A
Values:

0 No, Survey Grade GPS Coordinates **will not be collected** on plot
1 Yes, Survey Grade GPS Coordinates will be collected on plot

4.8 DECLINATION (CORE OPTIONAL 1.14) [DECLINATION]

Downloaded azimuth correction used to adjust magnetic north to true north. All azimuths are assumed to be magnetic azimuths unless otherwise designated. The PNW FIA units have historically corrected all compass readings for true north. This field is to be used only in cases where units are adjusting azimuths to correspond to true north; for units using magnetic azimuths, this field will always be set = 0 in the office. This field carries a decimal place because the USGS corrections are provided to the nearest half degree. DECLINATION is defined as: **DECLINATION = (TRUE NORTH - MAGNETIC NORTH)**

When collected: Downloaded for all plots
Field width: 4 digits including sign. (+xxx.y)
Tolerance: No errors
MQO: At least 99% of the time
Values: Downloaded values

4.9 QA STATUS (CORE 1.17) [QA STATUS]

Record the code to indicate the type of plot data collected, using the following codes:

When collected: All plots
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time

Values:

1	Standard production plot
2	Cold check
3	Reference plot (off grid)
4	Training/practice plot (off grid)
5	Botched plot file (disregard during data processing)
6	Blind check
7	Hot check (production plot)

4.10 CREW NUMBER (CORE 1.18) [CREWNBR1, CREWNBR2, CREWNBR3, CREWNBR4, CREWNBR5]

Record up to 5 crew numbers as assigned to the field crew; always record the crew leader first. The first 2 digits are for the responsible unit's station number (NRS – 24xxxx, SRS – 33xxxx, RMRS – 22xxxx, and PNW – 26xxxx).

When collected: All plots
Field Width: 6 digits
Tolerance: No errors
MQO: At least 99% of the time
Values: PNW 260000 – 269999

4.11 YEAR (CORE 1.13.1) [MEASYEAR]

Record the year that the plot was completed.

When collected: All plots
Field width: 4 digits
Tolerance: No errors
MQO: At least 99% of the time
Values: $\geq$ 2012

4.12 MONTH (CORE 1.13.2) [MEASMON]

Record the month that the plot was completed.

When collected: All plots
Field width: 2 digits
Tolerance: No errors
MQO: At least 99% of the time
Values:

January	01	May	05	September	09
February	02	June	06	October	10
March	03	July	07	November	11
April	04	August	08	December	12

4.13 DAY (CORE 1.13.3) [MEASDAY]

Record the day of the month that the plot was completed.

When collected: All plots
Field width: 2 digits
Tolerance: No errors
MQO: At least 99% of the time
Values: 01 to 31

4.14 PLOT STATUS (CORE1.4 [PLOT_STATUS-CD]

Record the code that describes the sampling status of the plot. In cases where a plot is inaccessible, but obviously contains no forest land, record PLOT STATUS = 2. In cases where a plot is access-denied or hazardous land use and has the possibility of forest, record PLOT STATUS = 3.

When collected: All plots
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values:

1 Sampled – at least one accessible forest land condition present on plot
2 Sampled – no accessible forest land condition present on plot
3 Nonsampled – possibility of forest land

4.15 NONFOREST SAMPLING STATUS (CORE 1.5) [NF_SAMPLING_STATUS_CD]

Record whether this plot is part of a nonforest inventory. If NONFOREST SAMPLING STATUS = 1, then the entire suite of attributes that are measured on the forest lands will be measured and only those suites of attributes that are measured on forest lands can be measured on nonforest lands.

When collected: All plots
Field width: 1 digit
Tolerance: no errors
MQO: At least 99% of the time
Values:

0 Nonforest plots / conditions are not inventoried
1 Nonforest plots / conditions are inventoried

4.16 NONFOREST PLOT STATUS (CORE 1.6) [NF_PLOT_STATUS_CD]

Record the code that describes the sampling status of the other-than-forest plot, i.e., PLOT STATUS = 2. In cases where the plot is inaccessible, but obviously contains no nonforest land, i.e., plot is either noncensus water or census water, record NONFOREST PLOT STATUS = 2.

When collected: When PLOT STATUS = 2 and NONFOREST SAMPLING STATUS = 1
Field width: 1 digit

Tolerance: no errors
MQO: At least 99% of the time
Values:

1	Sampled – at least one accessible nonforest land condition present on the plot
2	Sampled – no nonforest land condition present on plot, i.e., plot is either census and/or noncensus water
3	Nonsampled nonforest

4.17 PLOT NONSAMPLED REASON (CORE 1.7) [PLOT_NONSAMPLE_REASON_CD]

For entire plots that cannot be sampled, record one of the following reasons.

When collected: When PLOT STATUS = 3
Field width: 2 digits
Tolerance: No errors
MQO: At least 99% of the time
Values:

01	Outside U.S. boundary – Entire plot is outside of the U.S. border.
02	Denied access – Access to the entire plot is denied by the legal owner, or by the owner of the only reasonable route to the plot. Because a denied-access plot can become accessible in the future, it remains in the sample and is re-examined at the next occasion to determine if access is available.
03	Hazardous – Entire plot cannot be accessed because of a hazard or danger, for example cliffs, quarries, strip mines, illegal substance plantations, high water, etc. Although most hazards will not change over time, a hazardous plot remains in the sample and is re-examined at the next occasion to determine if the hazard is still present.
05	Lost data – Plot data file was discovered to be corrupt after a panel was completed and submitted for processing. This code is applied at the time of processing after notification to the units. This code is for office use only.
06	Lost plot – Entire plot cannot be found. Whenever this code is assigned, a replacement plot is required. The plot that is lost is assigned SAMPLE KIND = 2 and NONSAMPLED REASON = 6. The replacement plot is assigned SAMPLE KIND = 3.
07	Wrong location – Previous plot can be found, but its placement is beyond the tolerance limits for plot location. Whenever this code is assigned, a replacement plot is required. The plot being relocated is assigned SAMPLE KIND = 2 and NONSAMPLED REASON = 7. Its replacement plot is assigned SAMPLE KIND = 3.
08	Skipped visit – Entire plot skipped. Used for plots that are not completed prior to the time a panel is finished and submitted for processing. This code is for office use only.
09	Dropped intensified plot - Intensified plot dropped due to a change in grid density. This code used only by units engaged in intensification. This code is for office use only.

10	Other – Entire plot not sampled due to a reason other than one of the specific reasons already listed. A field note is required to describe the situation.

4.18 NONFOREST PLOT NONSAMPLED REASON (CORE 1.8) [NF_PLOT_NONSAMPLE_REASON_CD]

For entire plots that cannot be sampled, record one of the following reasons.

When collected: When PLOT STATUS = 2 and NONFOREST SAMPLING STATUS = 1 and NONFOREST PLOT STATUS = 3
Field width: 2 digits
Tolerance: No errors
MQO: At least 99% of the time
Values:

02	Denied access – Access to the entire plot is denied by the legal owner, or by the owner of the only reasonable route to the plot. Because a denied-access plot can become accessible in the future, it remains in the sample and is re-examined at the next occasion to determine if access is available.
03	Hazardous – Entire plot cannot be accessed because of a hazard or danger, for example cliffs, quarries, strip mines, illegal substance plantations, high water, etc. Although most hazards will not change over time, a hazardous plot remains in the sample and is re-examined at the next occasion to determine if the hazard is still present.
08	Skipped visit – Entire plot skipped. Used for plots that are not completed prior to the time a panel is finished and submitted for processing. This code is for office use only.
10	Other – Entire plot not sampled due to a reason other than one of the specific reasons already listed. A field note is required to describe the situation.

4.19 SUBPLOTS EXAMINED (CORE 1.9) [SUBP_EXAMINE_CD]

Record the number of subplots examined. By default, PLOT STATUS = 1 plots have all 4 subplots examined.

When collected: All plots
Field width: 1 digit
Tolerance: No errors
MQO: At least 90% of the time
Values:

1	Only subplot 1 center condition examined and all other subplots assumed (inferred) to be the same (remote sensing use only)
4	All four subplots fully described (no assumptions/inferences) (for field visited plots and plots viewed from a distance)

4.20 SAMPLE KIND (CORE 1.10) [KINDCD]

Record the code that describes the kind of plot being installed.

When collected: All plots
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values:

1	Initial plot establishment - the initial establishment and sampling of a national design plot (FIA Field Guide versions 1.1 and higher). SAMPLE KIND 1 is assigned under the following circumstances: Initial activation of a panel or subpanel Reactivation of a panel or subpanel that was previously dropped Resampling of established plots that were not sampled at the previous visit
2	Remeasurement – remeasurement of a national design plot that was sampled at the previous inventory.
3	Replacement plot - a replacement plot for a previously established plot. Assign SAMPLE KIND = 3 if a plot is re-installed at a location other than the original location (i.e., plots that have been lost, moved, or otherwise replaced). Note that replacement plots require a separate plot file for the replaced plot. Replaced plots are assigned SAMPLE KIND = 2, PLOT STATUS = 3, and the appropriate NONSAMPLED REASON code. The plot number for the new (replacement) plot is assigned by NIMS.

4.21 SAMPLE METHOD CODE (PNW) [DATA_SOURCE_PNWRS]

Record the code that describes the source for the data collected on the plot location.

When collected: All plots
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values:

1	Ground - All data collected from a ground visit by a field crew.
2	Viewed from a distance - Location was flown over or viewed from a distance (e.g., viewed from a road or adjacent ridgeline).
3	Photo Interpretation - Information for the location was determined using photo interpretation.
4	Other - Specify source of data in PLOT NOTES and on the plot card.

4.22 PREVIOUS PLOT NUMBER (CORE1.11) [REPLACED_PLOT_NBR]

Record the identification number for the plot that is being replaced.

When collected: When SAMPLE KIND = 3
Field width: 5 digits
Tolerance: No errors
MQO: At least 99% of the time
Values: 00001 to 99999

4.23 TRAILS OR ROADS (HAWAII) [RDCD]

Record the nearest trail or road to the plot. Use the plot photo, maps, or reasonable observations made while traveling to the plot to determine nearest trail or road (within 1 mile straight-line distance of the plot center). If two or more trails or roads are estimated to be equally distant, code the higher quality trail or road (lower code number). Base the coding decision on the condition of the road at the time of the visit.

When collected: All plots with either one accessible forest land condition class (PLOT STATUS = 1) or one accessible nonforest land condition class when nonforest is being sampled (PLOT STATUS = 2 and NONFOREST SAMPLING STATUS = 1 and NONFOREST PLOT STATUS =1

Field width: 1 digit
Tolerance: No errors
MQO: At least 90% of the time
Values:

0 None within 1 mile
1 Paved road or highway
2 Improved gravel road (has gravel, ditching, and/or other improvements)
3 Improved dirt road (has ditching, culverts, signs, reflectors, or other improvements)
4 Unimproved dirt road/four-wheel drive road (has no signs of any improvements)
5 Human access trail- clearly noticeable and primarily for recreational use

4.24 HORIZONTAL DISTANCE TO IMPROVED ROAD (CORE 1.15) [RDDISTCD]

Record the straight-line distance from plot center (subplot 1) to the nearest improved road. An improved road (TRAILS OR ROADS = 1, 2, or 3) is a road of any width that is maintained as evidenced by pavement, gravel, grading, ditching, and/or other improvements.

When collected: All plots with at least one accessible forest land condition class (PLOT STATUS = 1) or one accessible nonforest land condition class when nonforest is being sampled (PLOT STATUS = 2 and NONFOREST SAMPLING STATUS = 1 and NONFOREST PLOT STATUS =1

Field width: 1 digit
Tolerance: No errors
MQO: At least 90% of the time
Values:

1 100 ft or less
2 101 to 300 ft
3 301 to 500 ft
4 501 to 1000 ft
5 1001 ft to 1/2 mile
6 1/2 to 1 mile
7 1 to 3 miles
8 3 to 5 miles
9 Greater than 5 miles

4.25 ROAD ACCESS (HAWAII) [RDUSECD]

Record the first road access restrictions encountered while traveling to the plot. These restrictions limit car and truck access to the starting point for the walk to the plot, and may occur on ownerships encountered before reaching the plot area.

When collected: All plots with either one accessible forest land condition class (PLOT STATUS = 1) or one accessible nonforest land condition class when nonforest is being sampled (PLOT STATUS = 2 and NONFOREST SAMPLING STATUS = 1 and NONFOREST PLOT STATUS =1

Field width: 1 digit
Tolerance: No errors
MQO: At least 90% of the time
Values:

0	None – no road access restrictions
1	Road blocked by locked gate or cable across road
2	Road blocked by a human-made obstruction across road (ditch, mound, etc.)
3	Road blocked by natural occurrences (trees blown over onto road, road or bridge washed out)
4	Posted no motorized vehicle signs; road present, but restricted area such as Wilderness or National Park where vehicles are not allowed
9	Other – specify in PLOT NOTES

4.26 PUBLIC USE RESTRICTIONS (HAWAII) [PUBUSECD]

Record, if any, the restriction posted near or on the plot area that limits public use of the plot area; if more than one restriction occurs for the plot area, record the lowest number restriction present (1-3, 9).

When collected: All plots with either one accessible forest land condition class (PLOT STATUS = 1) or one accessible nonforest land condition class when nonforest is being sampled (PLOT STATUS = 2 and NONFOREST SAMPLING STATUS = 1 and NONFOREST PLOT STATUS =1

Field width: 1 digit
Tolerance: No errors
MQO: At least 90% of the time
Values:

0	None – no public use restrictions
1	Keep out / no trespassing
2	No hunting or fishing
3	No dumping
9	Other - specify in PLOT NOTES

4.27 RECREATION USE 1 (HAWAII) [REUSECD1]

Record up to 3 signs of recreation use encountered within the accessible forest land portion (and accessible nonforest land portion(s) when nonforest is being sampled) of any of the four subplots, based on evidence such as campfire rings, compacted areas (from tents), hiking trails, bullet or shotgun casings (if you are not on a military firing range), tree stands, etc. Record the recreation use that has had the most significant impact on the plot area first, then the second and third use. For example, in general numerous four-wheel drive or ATV trails would be coded before camping, and camping before hiking, and hiking before fishing. Use the coding system provided as a hierarchy. Do not repeat codes, except codes 0 and 9. Physical recreation evidence must be present to code 1-9. Also, disregard dumping where no evidence of recreation is present. Examine the plot area for clues before spending an exorbitant amount of time trying to find evidence that normally would not be found in the area; look for the obvious signs first.

When collected: All plots with either one accessible forest land condition class (PLOT STATUS = 1) or one accessible nonforest land condition class when nonforest is being sampled (PLOT STATUS = 2 and NONFOREST SAMPLING STATUS = 1 and NONFOREST PLOT STATUS =1

Field width: 1 digit
Tolerance: No errors
MQO: At least 90% of the time
Values:

0	No evidence of recreation use
1	Motor vehicle (four wheel drive, ATV, motorcycle, snowmobile)
2	Horse riding, dog team trails, ski trails
3	Camping
4	Hiking
5	Hunting/shooting
6	Fishing
7	Boating – physical evidence such as launch sites or docks
9	Other – recreation use where evidence is present, such as human litter, but purpose is not clear or does not fit into above categories.

4.28 RECREATION USE 2 (HAWAII) [REUSECD2]

Record the second most significant recreation use impact. See RECREATION USE 1 for coding instructions.

4.29 RECREATION USE 3 (HAWAII) [REUSECD3]

Record the third most significant recreation use impact. See RECREATION USE 1 for coding instructions.

4.30 WATER ON PLOT (CORE 1.16) [WATERCD]

Record the water source that has the greatest impact on the area within the accessible forest land portion of any of the four subplots. The coding hierarchy is listed in order from large permanent water to temporary water. This variable may be used for recreation, wildlife, hydrology, and timber availability studies.

When collected: All plots with at least one accessible forest land condition class (PLOT STATUS = 1) or one accessible nonforest land condition class when nonforest is being sampled (PLOT STATUS = 2 and NONFOREST SAMPLING STATUS = 1 and NONFOREST PLOT STATUS =1

Field width: 1 digit
Tolerance: No errors
MQO: At least 90% of the time
Values:

0	None – no water sources within the accessible forest land CONDITON CLASS
1	Permanent streams or ponds too small to qualify as noncensus water
2	Permanent water in the form of deep swamps, bogs, marshes without standing trees present and less than 1.0 ac in size, or with standing trees
3	Ditch/canal – human-made channels used as a means of moving water, such as irrigation or drainage which are too small to qualify as noncensus water
4	Temporary streams
5	Flood zones – evidence of flooding when bodies of water exceed their natural banks
6	Tidal water
9	Other temporary water – specify in PLOT NOTES

4.31 LANDOWNER PLOT SUMMARY REQUEST (PNW) [LAND_OWN_REQ_CD_PNWRS]

Record a 1-digit code which indicates if a landowner of the plot area requests a summary of the data collected on their land. Make any special comments relevant to the data request (e.g., landowner does not own all four subplots, the owner of subplot 2 would like data, etc.) in the electronic PLOT NOTES and use code 2.

When collected: All plots
Field width: 1 digit
Tolerance: No Errors
MQO: N/A
Values:

0	No data requested
1	Plot summary requested
2	Special case request – Requires PLOT NOTES

4.32 PLOT NOTES (CORE 1.21) [NOTES]

Use these fields to record notes pertaining to the entire plot. If the notes apply only to a specific subplot or other specific aspect of the plot, then make that clear in the notes.

When collected: All plots
Field width: 2000 characters
Tolerance: N/A
MQO: N/A
Values: English language words, phrases and numbers

4.33 Reference Point (RP) Attributes

Record the following items which describe the reference point (RP) and the course from the RP to the plot as described in "The reference point (RP)" on page 29. These data items should match what is recorded on the plot card and on the back of the photo.

4.33.1 RP TYPE (PNW) [RP_TYPE_PNWRS]

Record the type of object chosen as the reference point (RP).

When collected: All field visited plots
Field width: 1 digit
Tolerance: No errors
Values:

1	Tree or stump
2	Rock
3	Shrub
4	Other – specify in RP notes

4.33.2 RP SPECIES (PNW) [RP_SPCD_PNWRS]

If the RP is a tree or stump record the species code.

When collected: When RP TYPE = 1
Field width: 4 digits
Tolerance: No errors
Values: See Appendix 1 (Tree Species List, page 199)

4.33.3 RP DIAMETER (PNW) [RP_DIA_PNWRS]

If the RP is a tree or a stump, measure and record the DBH to the **nearest inch**.

When collected: When RP TYPE = 1
Field width: 3 digits
Tolerance: +/- 10 percent
Values: 001 to 999 to the nearest inch

4.33.4 RP AZIMUTH (PNW) [RP_AZIMUTH_PNWRS]

Record, in degrees, the azimuth from the RP to the plot center. When azimuth is determined using a GPS, include this information in the electronic RP NOTES and on the back of the photo.

When collected: All field visited plots
Field width: 3 digits
Tolerance: +/- 4 degrees
Values: 001 to 360

4.33.5 RP HORIZONTAL DISTANCE (PNW) [RP_DIST_PNWRS]

Record, to the nearest foot, the **horizontal** distance from the RP to the plot center; an RP should be within 5000 feet of plot center. When horizontal distance is collected using a GPS, include this information in the electronic RP NOTES and on the back of the photo.

When collected: All field visited plots
Field width: 4 digits
Tolerance: +/- 5 percent
Values: 0000 to 5000 feet

4.33.6 RP AZIMUTH/DISTANCE TO SUBPLOT NUMBER (PNW) [RP_SUBP_PNWRS]

Record the 1-digit number of the subplot which is referenced from the RP. Always reference to subplot 1 unless it is inaccessible (e.g., hazardous, denied access, census/non-census water). If subplot 1 center is inaccessible, the PC stake should be installed at the lowest numbered subplot that is accessible.

When collected: All field visited plots
Field width: 1 digit
Tolerance; No errors
Values: 1 to 4

4.33.7 RP NOTES (PNW) [RP_NOTES_PNWRS]

Record notes to explain any special RP situation that may need clarification for future plot visits. (e.g., shrub species, height/size of rock, RP not visited, RP AZIMUTH and RP HORIZONTAL DISTANCE collected with a GPS, etc.) Required if RP TYPE = 4 - other.

When collected: All field visited plots as needed to describe a special situation with the plot RP
Field width: 2000 characters
Tolerance: N/A
Value: Single words or abbreviated sentences

4.34 GPS Coordinates

Use a global positioning system (GPS) unit to determine the plot coordinates and elevation of all field-visited plot locations even if GPS has been used to locate the plot in the past.

4.34.1 Gps Unit Settings, Datum, and Coordinate System

Consult the GPS unit operating manual or other regional instructions to ensure that the GPS unit internal settings, including Datum and Coordinate system, are correctly configured. The Hawaiian and the Pacific Islands will use the WGS 84 Datum to collect coordinates. See Appendix 2 beginning on page 245.

Each FIA unit will determine which coordinate system to use. Regions using a Geographic system will collect coordinates in Degrees, Minutes, and Seconds of Latitude and Longitude; the regions using the UTM coordinate system will collect UTM Easting, Northing, and Zone.

4.34.2 Collecting Readings

Collect at least 180 GPS readings or let the GPS unit average for at least 3 minutes at the plot center. These may be collected in a file for post-processing or may be averaged by the GPS unit. Each individual position should have an error of less than 70 ft if possible (the error of all the averaged readings is far less).

Soon after arriving at plot center, use the GPS unit to attempt to collect coordinates. If suitable positions (180 readings at error less than or equal to 70 feet) cannot be obtained, try again before leaving the plot center.

If it is still not possible to get suitable coordinates from plot center, attempt to obtain them from a location within 200 feet of plot center. Obtain the azimuth and horizontal distance from the "offset" location to plot center. Record the azimuth and horizontal distance as described on pages 52-53.

Coordinates may be collected farther than 200 ft away from the plot center if a laser measuring device is used to determine the horizontal distance from the "offset" location to plot center. Again, record the azimuth and horizontal distance as described on pages 52 – 53.

In all cases try to obtain at least 180 readings or let the unit average at least 3 minutes before recording the coordinates.

4.34.3 Survey Grade GPS Coordinates

The objective of collecting Survey Grade GPS Coordinates is to obtain more accurate GPS coordinates for each field subplot location. Coordinates are used to precisely register plot information with remotely sensed imagery and data, and in relocating the plot at future inventories. Coordinates are collected using survey-grade GPS receivers.

Plots requiring Survey Grade GPS Coordinates will be preselected and triggered by the data item SURVEY GRADE GPS COORDINATES COLLECTED: 0 (No) or 1 (Yes). These coordinates will be collected on Experimental Forest plots on the Hawaiian Islands and other plots as decided by the

Hawaiian Coordinator. **Note: This is not a substitute for Handheld GPS Coordinates. Handheld GPS coordinates will still need to be collected.**

If crew is unable to collect survey grade GPS coordinates at a given subplot, enter GPS Unit Type = 0 for the appropriate subplot and include a note explaining why the data could not be collected.

Operation instructions for using the Survey Grade GPS units can be found in Appendix 3 starting on page 253.

When to collect Survey Grade GPS Coordinates:

1) When SURVEY GRADE GPS COORDINATES COLLECTED = 1 **AND** PLOT STATUS = 1 (sampled: at least one accessible forest land present on plot), coordinates should be taken at all subplots where the subplot center lands in accessible forest land or nonforest land (CONDITION CLASS STATUS 1 or 2).

2) When SURVEY GRADE GPS COORDINATES COLLECTED = 1 **AND** PLOT STATUS = 2 (sampled: no accessible forest land condition present on plot), coordinates should be taken on all subplots where the subplot center lands in a measurable nonforest condition class when nonforest is being measured (CONDITION CLASS STATUS = 2, NONFOREST SAMPLING STATUS = 1, NONFOREST CONDITION CLASS STATUS = 2.

The following data Items will be collected and entered into the data recorder.

4.34.4 GPS UNIT TYPE (CORE 1.19.3) [GPS_TYPE]

Record the kind of GPS unit used to collect coordinates. If suitable coordinates cannot be obtained, record 0, including when survey grade GPS data cannot be collected. Record “3” for Survey Grade GPS units. Record “2” for most standard handheld GPS units.

When collected: All field visited plots
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values:

0	GPS coordinates not collected (requires GPS NOTES)
1	Rockwell Precision Lightweight GPS Receiver (PLGR)
2	**Other brand capable of field averaging**
3	Other brands capable of producing files that can be post-processed (Survey Grade GPS)
4	Other brands not capable of field-averaging or post-processing

4.34.5 GPS SERIAL/UNIT NUMBER (CORE 1.19.4) [GPS_SERIAL_NBR]

Record the last six digits of the serial number on the GPS unit used. For survey grade GPS units there may be less than six digits for the unit number. In this case record the entire unit number.

When collected: When GPS UNIT > 0
Field width: 6 digits
Tolerance: No errors
MQO: At least 99% of the time
Values: 000001 to 999999

4.34.6 GPS DATUM (CORE 1.19.6) [GPS_DATUM]

This is an auto-generated code indicating the map datum that the GPS coordinates are collected in (i.e. the map datum selected on the GPS unit to display the coordinates).

When collected: When GPS UNIT = 1, 2, or 4
Field width: 5 characters (cccnn)
Tolerance: No errors
MQO: At least 99% of the time
Values: WGS84

4.34.7 COORDINATE SYSTEM (CORE 1.19.7) [GPS_COORD_SYS]

This is an auto-generated code indicating the type of coordinate system used to obtain readings.

When collected: When GPS UNIT = 1, 2, or 4
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values: 2 (UTM coordinate system)

4.34.8 GPS LOCATION TYPE (PNW) [GPS_LOC_TYPE]

Record the location type for coordinates collected on the ground. Record codes 1-7 for handheld units. Record codes 15-18 for survey grade GPS coordinates.

When collected: All GPS records
Field width: 2 digits
Tolerance: No errors
Values:

1	LZ/TR Landing zone / Truck parking spot
2	RP Reference point
3	PC Plot center (PC) (required)
4	Subplot 2 Use only if PC not possible
5	Subplot 3 Use only if PC not possible
6	Subplot 4 Use only if PC not possible
7	Other Describe in GPS NOTES

The following values are required when SURVEY GRADE GPS COORDINTATES COLLECTED = 1

15	Survey grade GPS coordinates for subplot 1
16	Survey grade GPS coordinates for subplot 2
17	Survey grade GPS coordinates for subplot 3
18	Survey grade GPS coordinates for subplot 4

4.34.9 UTM ZONE (CORE 1.19.10) [UTM_ZONE]

Record THE UTM ZONE **as determined by GPS**. See Appendix 2 HANDHELD GPS COORDINATES to confirm settings and proper UTM Zone.

When collected: When COORDINATE SYSTEM = 2
Field width: 3 digits
Tolerance: No errors
MQO: At least 99% of the time
Values: 4 or 5

4.34.10 EASTING (X) UTM (CORE 1.19.11) [UTM_EASTING_X]

Record the Easting coordinate as determined by GPS.

When collected: When COORDINATE SYSTEM = 2
Field width: 7 digits
Tolerance: +/- 140 ft
MQO: At least 99% of the time
Values: 0000000-9999999

4.34.11 NORTHING (Y) UTM (CORE 1.19.12) [UTM_NORTHING_Y]

Record the Northing coordinate as determined by GPS.

When collected: When COORDINATE SYSTEM = 2
Field width: 7 digits
Tolerance: +/- 140 ft
MQO: At least 99% of the time
Values: 0000000-9999999

4.34.12 GPS ELEVATION (CORE 1.19.16) [GPS_ELEV]

Record the elevation above mean sea level, in feet, as determined by GPS.

When collected: When GPS UNIT = 1, 2 or 4
Field width: 6 digits (1st digit is + or -, last 5 digits are numeric)
Tolerance: +/- 280 feet
MQO: At least 99% of the time
Values: -00100 to 20000

4.34.13 GPS ERROR (CORE 1.19.17) [GPS_ERROR]

Record the error as shown on the GPS unit to the nearest foot. As described in Section 4.34.2, make every effort to collect readings only when the error less than or equal to 70 ft. However, if after trying several different times during the day, at several different locations, this is not possible, record reading with an error of up to 999 ft.

When collected: When GPS UNIT =1 or 2
Field width: 3 digits
Tolerance: No errors
MQO: At least 99% of the time
Values: 000 - 999
(071 to 999 if an error of less than 70 cannot be obtained)

4.34.14 NUMBER OF READINGS (CORE 1.19.18) [GPS_NBR_READINGS]

Record a 3-digit code indicating how many readings were averaged by the GPS unit to calculate the plot coordinates. Collect at least 180 readings if possible.

> When collected: When GPS UNIT = 1 or 2
> Field width: 3 digits
> Tolerance: No errors
> MQO: At least 99% of the time
> Values: 001 to 999

4.34.15 ANTENNA HEIGHT (PNW) [GPS_ANTENNA_HT_PNWRS]

Record the ANTENNA HEIGHT of the Survey Grade GPS Unit to the nearest 1/100 foot. Include the decimal point.

> When collected: All records where GPS UNIT TYPE = 3 **AND** GPS LOCATION TYPE = 15, 16, 17, or 18
> Field Width: 4 digits (including decimal point)
> Tolerance: No Errors
> MQO: At least 99% of the time
> Values: 0.01 to 9.99 feet

4.34.16 TIME RECORDING STARTED (PNW) [GPS_RECORDING_START_TIME_PNWRS]

Record the time that the Survey Grade GPS unit started recording. Record military (24 hour) time in hours and minutes (HHMM).

> When collected: All records where GPS UNIT TYPE = 3 **AND** GPS LOCATION TYPE = 15, 16, 17, or 18
> Field Width: 4 digits
> Tolerance: No Errors
> MQO: At least 99% of the time
> Values: 0000 to 2359

4.34.17 TIME RECORDING STOPPED (PNW) [GPS_RECORDING_END_TIME_PNWRS]

Record the time that the Survey Grade GPS unit stopped recording. **This must be at least 15 minutes after the time recorded in TIME RECORDING STARTED**. Record military (24 hour) time in hours and minutes (HHMM).

> When collected: All records where GPS UNIT TYPE = 3 **AND** GPS LOCATION TYPE = 15, 16, 17, or 18
> Field Width: 4 digits
> Tolerance: No Errors
> MQO: At least 99% of the time
> Values: 0000 to 2359, at least 15 minutes later than TIME RECORDING STARTED

4.34.18 YEAR (PNW) [GPS_MEASYEAR_PNWRS]

Record the year that Survey Grade GPS Coordinates were collected

> When collected: All plots where GPS UNIT TYPE = 3 **AND** GPS LOCATION TYPE = 15, 16, 17, or 18
> Field width: 4 digits
> Tolerance: No errors
> MQO: At least 99% of the time
> Values: ≥ 2012

4.34.19 MONTH (PNW) [GPS_MEASMON_PNWRS]
Record the month that Survey Grade GPS Coordinates were collected

When collected: All plots where GPS UNIT TYPE = 3 **AND** GPS LOCATION TYPE = 15, 16, 17, or 18
Field width: 2 digits
Tolerance: No errors
MQO: At least 99% of the time

Values:

January	01	May	05	September	09
February	02	June	06	October	10
March	03	July	07	November	11
April	04	August	08	December	12

4.34.20 DAY (PNW) [GPS_MEASDAY_PNWRS]
Record the day of the month that Survey Grade GPS Coordinates were collected

When collected: All plots where GPS UNIT TYPE = 3 **AND** GPS LOCATION TYPE = 15, 16, 17, or 18
Field width: 2 digits
Tolerance: No errors
MQO: At least 99% of the time
Values: 01 to 31

4.34.21 CREW NUMBER (PNW) [CREWNBR1]
Record the CREW NUMBER of the person on the field crew recording GPS Coordinates with the Survey-Grade receiver at the subplot.

When collected: When GPS UNIT TYPE = 3 **AND** GPS LOCATION TYPE = 15, 16, 17, or 18
Field Width: 6 digits
Tolerance: No errors
MQO: At least 99% of the time
Values: PNW 260000 – 269999

4.34.22 GPS NOTES (PNW) [NOTES]
Record any notes needed to clarify or explain a special situation in the particular GPS record being defined

When collected: As needed: required when GPS LOCATION TYPE 7 or GPS UNIT TYPE = 0
Field width: 2000 characters
Tolerance: N/A
MQO: N/A
Value: Words or abbreviated sentences

4.35 Correction For Offset Location
At times coordinates may be taken at a location other than plot center (an “offset location”) (GPS LOCATION TYPE = 3) or subplot center (GPS LOCATION TYPE = 15, 16, 17, or 18). Record the two data items below.

4.35.1 AZIMUTH TO CENTER (CORE 1.19.14) [GPS_AZM_PNWRS]
For non-survey grade GPS units record the azimuth from the location where coordinates were collected to actual **plot center**. If coordinates are collected at plot center, record 000. ***For survey***

grade GPS units record the azimuth from the location where coordinates were collected to actual **subplot center.** If coordinates are collected at subplot center, record 000.

When collected: When GPS LOCATION TYPE = 3, 15, 16, 17, or 18and GPS UNIT = 2, 3 or 4
Field width: 3 digits
Tolerance +/- 3 degrees
MQO: At least 99% of the time
Values:

000 when coordinates **are** collected at plot center (GPS LOCATION TYPE = 3) or subplot center (GPS LOCATION TYPE = 15, 16, 17, or 18)

001 to 360 when coordinates **are not** collected at plot center (GPS LOCATION TYPE = 3) or subplot center (GPS LOCATION TYPE = 15, 16, 17, or 18)

4.34.2 DISTANCE TO CENTER (CORE 1.19.15) [GPS_DIST] & [GPS_DIST_PNWRS]

For non-survey grade GPS units record the horizontal distance**, to the nearest foot**, from the location where coordinates were collected to the actual plot center. If coordinates are collected at plot center, record 000 as described in Section 4.34.2, if a Laser range finder is used to determine DISTANCE TO PLOT CENTER, offset locations may be up to 999 ft from the plot center. If a range finder is not used, the offset location must be within 200 ft. ***For survey grade GPS units*** record the horizontal distance, **to the nearest 1/10 foot**, from the location where Survey Grade GPS Coordinates were collected to the subplot center. This distance should be within 99.9 feet. If coordinates are collected at subplot center, record 000.0

When collected: When GPS LOCATION TYPE = 3, 15, 16, 17, or 18and GPS UNIT = 2, 3 or 4
Field width: 4 digits (including decimal place) for GPS LOCATION TYPE 15, 16, 17, or 18
3 digits (no decimal place) for GPS LOCATION TYPE 3
Tolerance: +/- 6 ft (When GPS LOCATION TYPE = 3)
MQO: At least 99% of the time
Values:

The following are recordable values when GPS LOCATION TYPE = 3:

000 when coordinates **are** collected at plot center
000 to 200 when a Laser range finder **is not** used to determine distance
000 to 999 when a Laser range finder **is** used to determine distance

The following are recordable values when GPS LOCATION TYPE = 15, 16, 17, or 18:

000.0 when coordinates **are** collected at subplot center
000.1 to 099.9 when coordinates **are not** collected at subplot center

Plot Level Data

5 CONDITION CLASS DATA

The Forest Inventory and Analysis (FIA) plot is a cluster of four subplots in a fixed pattern. Subplots are never reconfigured or moved in order to confine them to a single condition class; a plot may straddle more than one condition class. Every plot samples at least one condition class: the condition class present at plot center (the center of subplot 1).

5.1 Determination of Condition Class

5.1.1 Step 1: Delineate the plot area by CONDITION CLASS STATUS

The first attribute considered when defining a condition class is CONDITION CLASS STATUS. The area sampled by a plot is assigned into condition classes based upon the following differences in CONDITION STATUS:

1. Accessible forest land (See definition on page 60)
2. Nonforest land
3. Noncensus water
4. Census water
5. Nonsampled – possibility of forest land

Accessible forest land defines the population of interest for FIA purposes. This is the area where most of the data collection is conducted.

5.1.2 Step 2: Further subdivide Accessible Forest Land by 6 delineation variables

Any condition class sampled as accessible forest land may be further subdivided, in order of listed priority, into smaller condition classes if distinct, contrasting condition classes are present because of variation within the sampled area in any of the following attributes within the sample area:

1. RESERVED STATUS
2. OWNER GROUP
3. FOREST COMMUNITY
4. STAND SIZE CLASS
5. REGENERATION STATUS
6. TREE DENSITY

No other attribute shall be the basis for recognizing contrasting accessible forest land condition classes. For each condition class recognized, several “ancillary attributes” that help describe the condition will be collected, but will not be used for delineation purposes (see Section 5.7).

5.2 Condition Class Attributes List

A CONDITION CLASS NUMBER and a classification for CONDITION CLASS STATUS are required for every condition class sampled on a plot. For each condition class classified as accessible forest land, a classification is required for each of the following attributes:

5.6.1 RESERVED STATUS =
5.6.2 OWNER GROUP =
5.6.4 FOREST COMMUNITY =
5.6.5 STAND SIZE =
5.6.6 REGENERATION STATUS =
5.6.7 TREE DENSITY =

Attributes where a change causes a separate condition class

……………………………………………………

5.6.3 PREVIOUS OWNER GROUP =
5.7.1 OWNER CLASS =
5.7.2 PRIVATE OWNER INDUSTRIAL STATUS =
5.7.3 ARTIFICIAL REGENERATION SPECIES =
5.7.4 STAND AGE =
5.7.5 DOMINANT TREE SPECIES =
5.7.8 DISTURBANCE (up to 3 coded) =
5.7.9 DISTURBANCE YEAR (1 per disturbance) =
5.7.14 TREATMENT (up to 3 coded) =
5.7.15 TREATMENT YEAR (1 per treatment)=
5.7.20 CONDITION CLASS SLOPE =
5.7.21 CONDITION CLASS ASPECT =
5.7.22 PHYSIOGRAPHIC CLASS =
5.7.23 SLOPE SHAPE =
5.7.24 SLOPE POSITION =
5.7.25 PRESENT NONFOREST LAND USE=
5.7.26 CANOPY COVER SAMPLE METHOD=
5.7.27 LIVE CANOPY COVER =
5.7.28 LIVE PLUS MISSING CANOPY COVER=
5.7.29 TOTAL STEMS =
5.8 CONDITION NONSAMPLED REASON=
5.9 NONFOREST CONDITION NONSAMPLED REASON=
5.10 CONDITION CLASS NOTES =

Ancillary changes do not delineate a new condition class

Specific instructions for the classification of each attribute follow.

5.3 Delineating Condition Classes Differing In Condition Status:

The first step in delineating condition classes is to recognize differences in CONDITION CLASS STATUS. The most common difference is adjacent accessible forest land and nonforest land. Adjacent accessible forest land and nonforest land condition classes are recognized only if each of the two prospective condition classes is at least 1.0 acre in size, and each is at least 120.0 feet in width. These size and width minimums apply to both accessible forest land and nonforest land.

Within an accessible forest land condition class, unimproved roads, rock outcrops, and natural nonforest openings less than 1.0 acre in size and less than 120.0 feet in width are considered forest land and are not delineated and classified as a separate nonforest land condition class.

Within a nonforest land condition class, forested areas or linear strips of trees less than 1.0 acre in size and less than 120.0 feet in width are considered part of the nonforest land condition class.

Five exceptions to these size and width requirements apply:

1. Developed nonforest condition: human-caused nonforest land condition classes such as homes or cabins that are less than 1.0 ac in size and 120.0 ft in width and are surrounded by forest land. There are three kinds of developed nonforest conditions that do not have to meet area or width requirements (Figures 2 and 3).

    a) Improved roads: paved roads, gravel roads, or improved dirt roads regularly maintained for long-term continuing use. Unimproved traces and roads created for skidding logs are not considered improved roads

    b) Maintained rights-of-way: corridors created for railroads, power lines, gas lines, and canals that are periodically treated to limit the establishment and growth of trees and shrubs.

    c) Developments: structures and the maintained area next to a structure, all less than 1.0 ac in size and surrounded by forest land. Examples of developments are houses or trailers on very small lots, communication installations in a small cleared area within forest land, and barns and sheds.

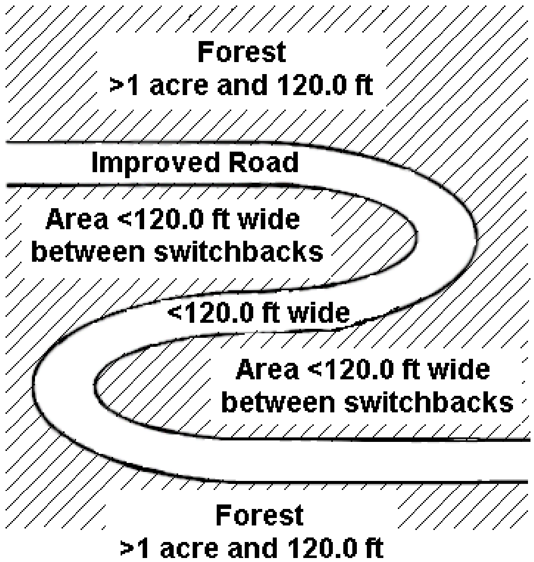


Figure 2. Example of a switchback road.

The area between the switchbacks is coded as Forested Condition Class

The improved road is a Nonforest Condition Class

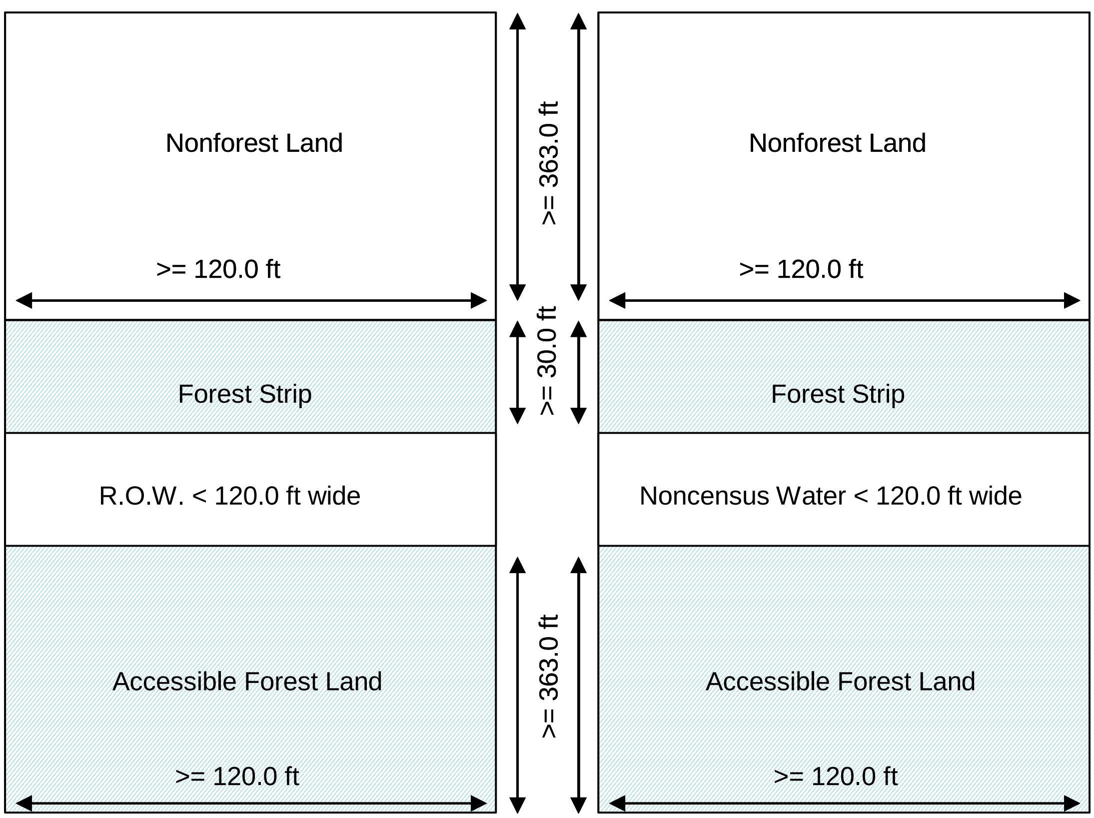


Figure 3. Example of nonforest and forest strips.

2. Distinct, alternating strips of forest and nonforest land: this situation occurs when a plot or subplot samples a condition class that is less than 1.0 acre in size and less than 120.0 feet in width. The condition class is one of a series of parallel strips of forest and nonforest land in which none of the strips meet the minimum width requirement. This exception applies only to nonforest land conditions that are not listed under #1, e.g., improved roads, maintained rights-of-way, and developments (fig. 3).

a) Many small intermingled strips, determine the total area that the intermingled strips occupy, and classify according to the CONDITION CLASS STATUS (forest land or nonforest land) that occupies the greater area. If the area of intermingled strips is so large or indistinct as to make a total area determination impractical, then classify the sample as forest land.

b) Two alternating strips: For two alternating strips of forest and nonforest between two qualifying areas of nonforest land and forest land, see figure 4. Figure 4 delineates the boundary between the forest and nonforest land condition classes for four different examples. The plot center defines the plot condition for all strips covered by the arrow. Any subplot that falls in the alternating strips uses the rule. Any subplot that falls in assigned nonforest / forest is assigned that type. Again, this exception applies only to nonforest land conditions that are not listed under number 1, e.g., improved roads, maintained rights-of-way, and developments.

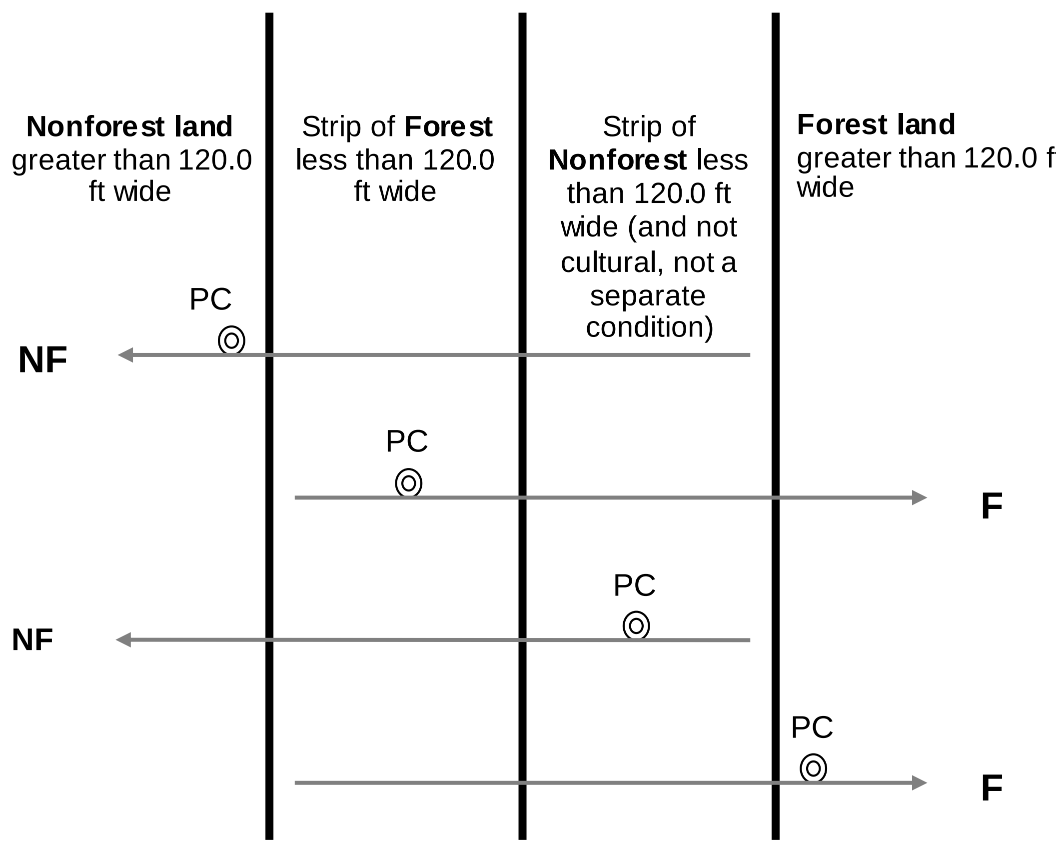


Figure 4. Example of alternating strips of forested and nonforested conditions. PC is the plot center (center of subplot 1).

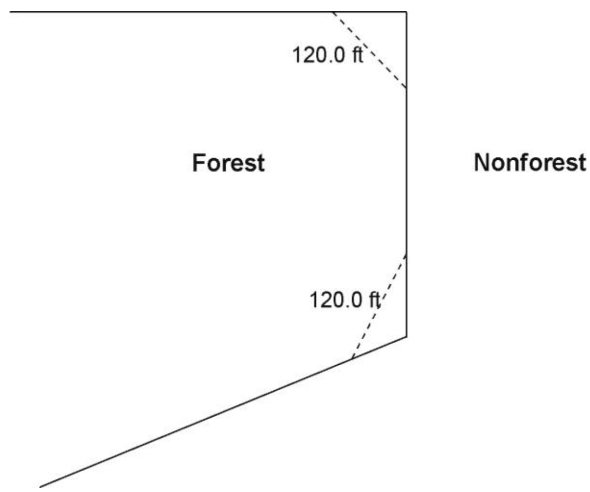


Figure 5. Illustration of the 90 degree corner rule. The dotted lines do not create nonforest conditions.

3. The 120 foot minimum width for delineation does not apply when a corner angle is 90 degrees or greater (Figure 5).

4. Linear water features: natural water features that are linear in shape such as streams and rivers. A linear water feature must meet the definition for Census or noncensus water to be nonforest area. Therefore, a linear water feature must be at least 30.0 feet wide and cover at least 1.0 acre. The width of a linear water feature is measured across its channel between points on either side up to which water prevents the establishment and survival of trees. To determine whether a linear water feature qualifies as nonforest, rely on all available information on hand such as aerial photos, topographic maps, past survey land calls, and ocular estimates at the current survey visit. Linear water features that do not meet the definition for Census or noncensus water should be classified as forest land only if bounded by forest land on both shores. Crews are NOT expected to measure the length of a linear water feature to determine if it meets the 1.0 acre requirement; use professional judgment and common sense on any linear water feature.

5. Nonsampled conditions within accessible forest land are delineated, regardless of size, as a separate condition.

Condition Status Definitions:

5.3.1 Accessible Forest Land

Land that is within the population of interest, is accessible, is on a subplot that can be occupied at subplot center, can safely be visited, and meets the following criteria:

The condition has at least 10 percent crown cover by trees of any size, or has had at least 10 percent crown cover in the past. Additionally, the condition is not subject to nonforest use(s) that prevent normal tree regeneration and succession such as regular mowing, intensive grazing, or recreation activities.

A condition class has 10 percent crown cover if the crown area of all trees occupies 10 percent of the total area within that condition class if viewed from above.

To qualify as forest land, the prospective condition must be at least 1.0 acre in size and 120.0 feet wide measured stem-to-stem from the outer-most edge. Forested strips must be 120.0 feet wide for a continuous length of at least 363.0 feet in order to meet the acre threshold. Forested strips that do not meet these requirements are classified as part of the adjacent nonforest land.

Transition zones and forest/nonforest encroachment – When an accessible forest land condition encroaches into a nonforest land condition, the border between forest and nonforest is often a gradual change in tree cover or stocking with no clear and abrupt boundary. In addition, it may be difficult to determine exactly where the forested area meets the minimum stocking criteria and where it does not. For these cases, determine where the land clearly meets the 10 percent minimum crown cover, and where it clearly is less than required crown cover; divide the zone between these points in half, and determine the side of the zone on which the subplot center is located. Classify the condition class of the subplot based on this line (fig. 6).

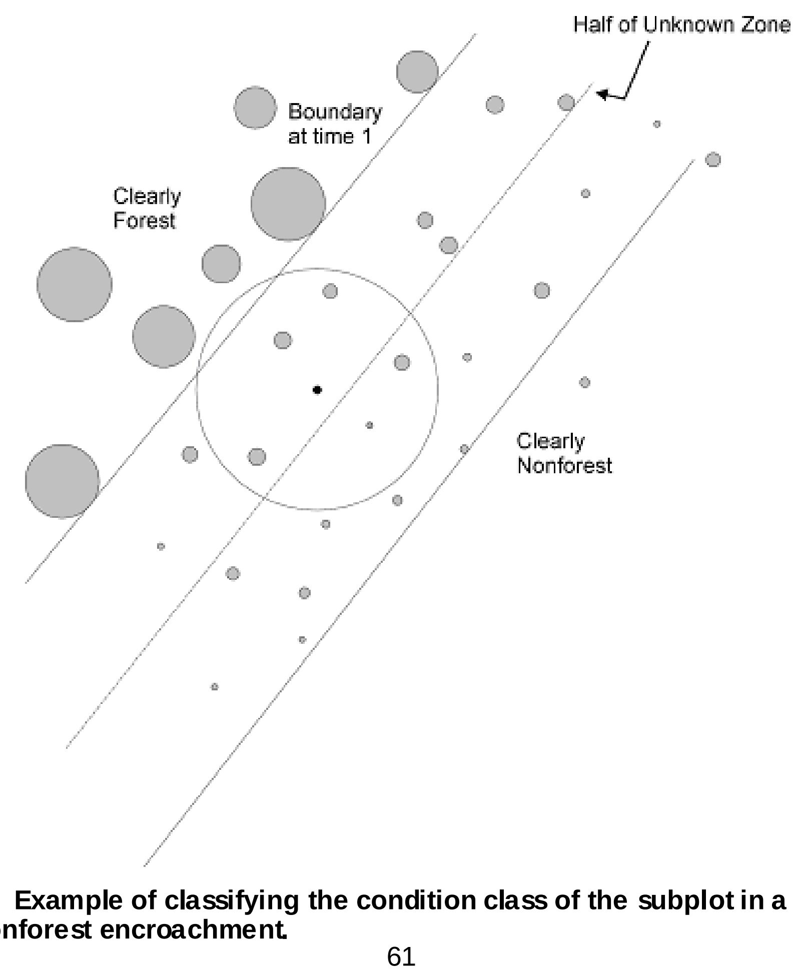


Figure 6. Example of classifying the condition class of the subplot in a transition zone with forest/nonforest encroachment.

For example, at measurement time 1, a clear and distinct boundary existed between the forest and nonforest condition classes. At time 2, however, there now exists a zone of regeneration or small diameter trees between the previous forest condition and where the nonforest clearly remains. If the zone of encroachment clearly has 10 percent crown cover where it meets the nonforest, classify the entire zone as forest. If the zone is clearly nonforest up to the original stand, call it all nonforest. If the encroachment or transition zone does not clearly have 10 percent crown cover where it meets the nonforest, determine where it clearly has 10 percent crown cover (forest) and where it clearly does not have 10 percent crown cover (nonforest); divide this zone in half, and classify the entire subplot based on which side of the line the subplot center falls.

Treated strips – Occasionally, crews will come across plantations of trees, in which rows of trees alternate with strips of vegetation that have been bulldozed, mowed, tilled, treated with herbicide, or crushed. Because these strip treatments are conducted to optimize growth or to release the stand, the areas are considered forest land, and the treatment is considered a timber stand improvement operation. Do not confuse these practices with similar treatments on nonforest lands such as yards or rights-of-way. Contact with the landowner may help determine the intent of a treatment.

Indistinct boundary due to the condition minimum-width definition – Do not subdivide subplots where a condition class may change due only to the forest vs. nonforest minimum width (120.0 feet) definition. Although the point where the definition changes from forest to nonforest creates an invisible "line" between conditions, **this definitional boundary is not distinct and obvious**. See figures 7 and 8. Where the point of the definition change occurs on the subplot, determine only if the subplot center is on the forest or nonforest side of that approximate boundary, and classify the entire subplot based on the condition of the subplot center. If the boundary crosses through the center of the subplot, classify the subplot as the condition it most resembles. If the boundary occurs between subplots, classify each subplot based on its relation to the definitional boundary.

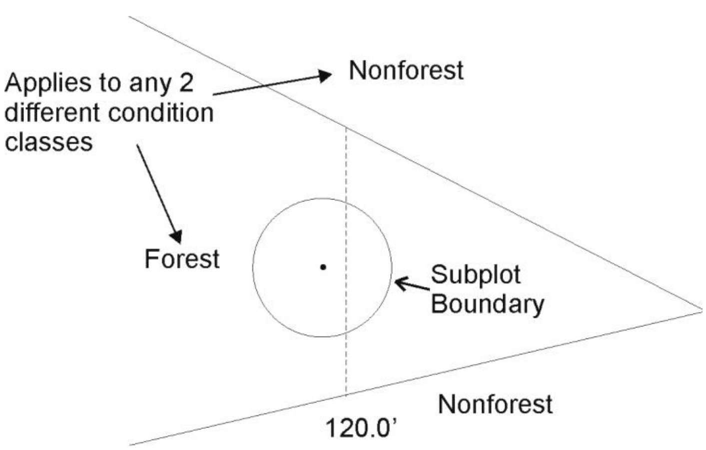


Figure 7. Forest condition narrows within a nonforest condition. Examine the location of the subplot/macroplot center in reference to the approximate line where the forest narrows to 120.0 ft wide. In this example, the entire subplot is classified as forest.

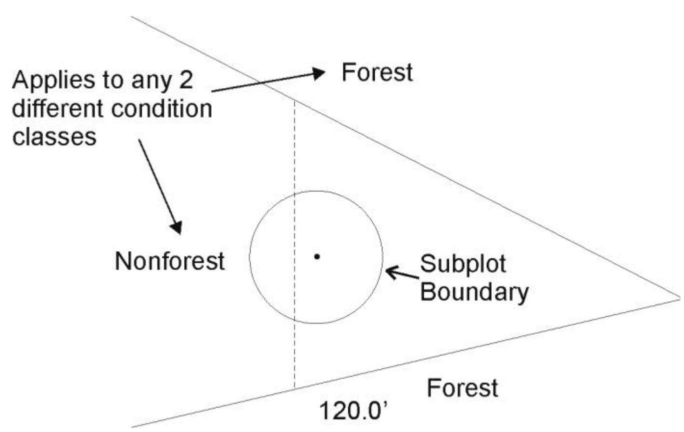


Figure 8. Nonforest condition narrows within a forest condition. Examine the location of the subplot/macroplot center in reference to the approximate line where the nonforest narrows to 120.0 ft wide. In this example, the entire subplot is classified as forest.

5.3.2 Nonforest Land

Nonforest land is any land within the sample that does not meet the definition of accessible forest land or any of the CONDITION STATUS values defined in Sections 5.3.3 through 5.3.5. To qualify, the area must be at least 1.0 ac in size and 120.0 ft wide, five exceptions are discussed at the beginning of section 5.3. Do not consider evidence of "possible" or future development or conversion. A nonforest land condition will remain in the sample and will be examined at the next plot visit to see if it has become forest land.

5.3.3 Noncensus Water

Lakes, reservoirs, ponds, and similar bodies of water 1.0 ac to 4.5 ac in size. Rivers, streams, canals, etc., 30.0 ft to 200 ft wide.

5.3.4 Census Water

Ocean (below mean high tide line),Lakes, reservoirs, ponds, and similar bodies of water 4.5 ac in size and larger; and rivers, streams, canals, etc., more than 200 ft wide (1990 U.S. Census definition).

5.3.5 Nonsampled

See 5.8 CONDITION NONSAMPLED REASON for descriptions of land that qualifies as nonsampled. In cases where a condition is access-denied or hazardous land use, but obviously contains no forest land, record CONDITION CLASS STATUS = 2, 3 or 4. In cases where a condition is access-denied or hazardous land use and has the possibility of forest, record CONDITION CLASS STATUS = 5.

5.4 Delineating Condition Classes Within Accessible Forest Land:

Accessible forest land is subdivided into condition classes that are based on differences in RESERVED STATUS, OWNER GROUP, FOREST COMMUNITY, STAND SIZE CLASS, REGENERATION STATUS, and TREE DENSITY. Section 5.1.2 applies when delineating contrasting forest condition classes. Specific criteria apply for each of the six attributes and are documented by attribute in subsections within 5.6.1 to 5.6.7 (minus PREVIOUS OWNER GROUP). “Stands” are defined by plurality of crown cover for all live trees that are not overtopped.

Additionally, each separate forest condition class recognized within accessible forest land must be at least 1.0 acre in size and at least 120.0 feet in width. If prospective contrasting forest land condition classes do not each meet these minimum size and width requirements, the most similar prospective conditions should be combined until these minimums are attained.

No other attribute shall be the basis for recognizing contrasting condition classes within accessible forest land. For each condition class recognized, many “ancillary attributes” that help describe the condition will be collected, but will not be used for delineation purposes (see Section 5.7).

General instructions for delineating condition classes within accessible forest lands:

1. ***Distinct boundary within a subplot or microplot***: Separate condition classes ARE recognized if, within a subplot, two (or more) distinctly different condition classes are present and delineated by

a distinct, abrupt boundary. The boundary is referenced; see Section 7.0 BOUNDARY REFERENCES.

2. Indistinct boundary within a subplot: Separate condition classes are NOT recognized if the prospective condition classes abut along an indistinct transition zone, rather than on an abrupt, obvious boundary. Only one condition is recognized, and the subplot is classified entirely as the condition it most resembles.

Example: The four subplots all sample only accessible forest land. Subplots 1, 3, and 4 sample what is clearly a stand of large-diameter trees. Subplot 2 falls in the middle of a stand-size transition zone. In the zone, the large-diameter stand phases into a sapling stand.

Subplot 2 must not be divided into two condition classes on the basis of stand size. Instead, it is treated entirely as part of the large-diameter condition class or is assigned entirely to a new condition class that is classified as a seedling-sapling stand. The latter occurs only if the crew thinks the entire subplot is more like a stand of seedlings-saplings than a stand of large-diameter trees; then the boundary between the large- and small-diameter stands is assumed to occur between and not on the subplots.

3. A boundary or transition zone between fixed radii plots that sample distinctly different condition classes: Separate condition classes are recognized and recorded when a valid attribute obviously differs between two fixed radius plots, but a distinct boundary or indistinct transition zone exists outside the sampled (fixed-radius) area of the subplots. In such cases, a boundary, if present, is not referenced.

Example: The northernmost subplot (2) samples entirely accessible forest land. The other three subplots, 1, 3, and 4, fall clearly in a nonforest meadow. Between subplot 1 and 2 is a transition zone; the number of trees present goes from none to what clearly represents at least 10 percent crown cover Two condition classes are sampled: accessible forest land sampled on subplot 2, and nonforest land sampled on the other subplots.

4. A riparian forest area is defined as a forest area between 30.0 and 120.0 feet wide, and 1.0 acre or more in size, cumulative, and adjacent to but not necessarily present on both sides of a naturally occurring or artificially created body of water or watercourse with continuous or intermittent flow. Riparian forest areas may be associated with but not limited to streams, rivers, lakes, sloughs, seeps, springs, marsh, bogs, beaver ponds, sink holes, cypress domes and ponds, man-made ditches and canals. A riparian forest area must be associated “within forest” and contain at least one distinct and obvious change in a condition class delineation attribute from its adjacent accessible forest land condition class. Figures 9-14 provide examples of when to delineate riparian forest area as a separate condition class.

Note: When the width of forest adjacent to a stream is between 120.0 feet and 150.0 feet and the width of the riparian forest is at least 30.0 feet wide, the rules for identifying the non-riparian forest (at least 30.0 feet but less than 120.0 feet) need to be modified. The non-riparian forest can be between 30.0 feet and 120.0 feet and mapped as a separate condition as long as it meets the criteria for delineating a separate condition class, otherwise it will be an inclusion in the riparian forest condition class.

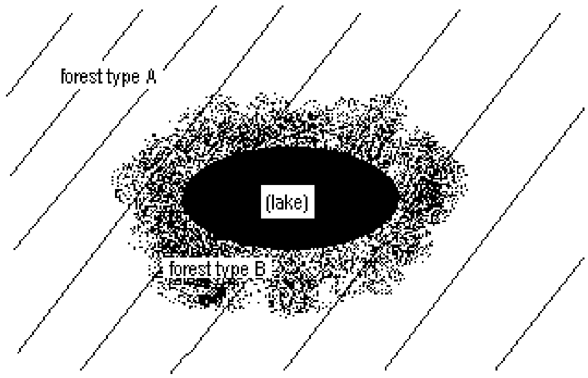


Figure 9. FOREST COMMUNITY B is a separate condition class (riparian) if the band of it is between 30.0 feet and 120.0 feet wide, and is ≥ 1.0 acre in size.

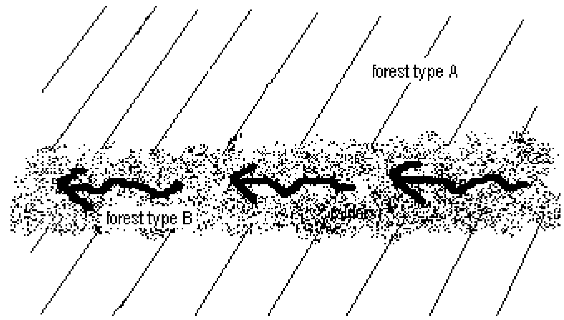


Figure 10. FOREST COMMUNITY B is a separate condition class (riparian) if the band of it is between 30.0 feet and 120.0 feet wide, and is ≥ 1.0 acre in size.

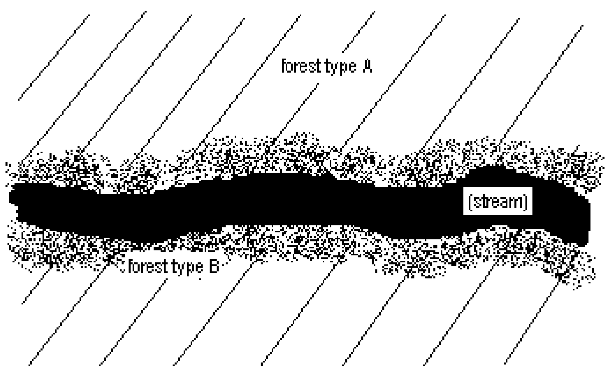


Figure 11. If the stream is < 30.0 feet wide, FOREST COMMUNITY B is a separate condition class (riparian) if the sum of the two widths of the bands, including the stream falls between 30.0 feet and 120.0 feet wide, and is ≥ 1.0 acre in size.

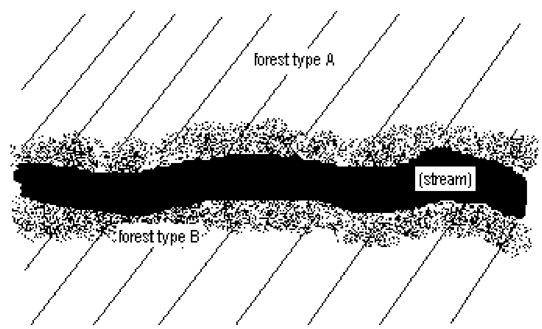


Figure 12. If the stream is > 30.0 feet wide, FOREST COMMUNITY B is a separate condition class (riparian) if either of the two widths of the bands falls between 30.0 feet and 120.0 feet wide and is ≥ 1.0 acre in size.

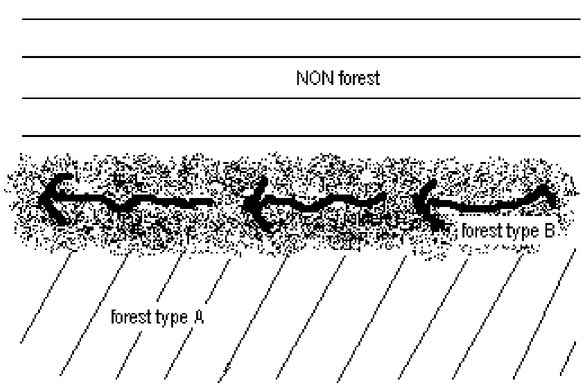


Figure 13. FOREST COMMUNITY B is a separate condition class (riparian) if the band of it is between 30.0 feet and 120.0 feet wide, and is ≥ 1.0 acre in size.

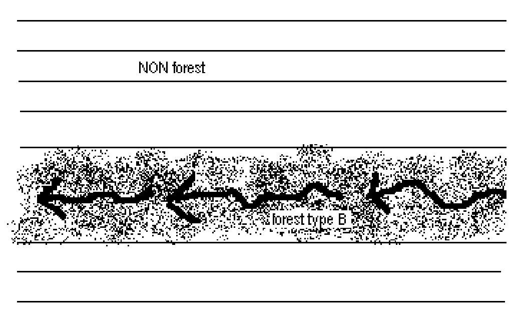


Figure 14. In a nonforested area, a band of FOREST COMMUNITY B that is < 120.0 feet wide is NOT considered a riparian area. It is not a separate condition class at all.

5.5 *General Condition Class Attributes*

General attributes such as CONDITION CLASS NUMBER and a classification for CONDITION CLASS STATUS are required for every condition class sampled on a plot.

5.5.1 CONDITION CLASS NUMBER (CORE 2.4.1) [CONDID]

On a plot, assign and record a number for each condition class. The condition class at plot center (the center of subplot 1) is designated condition class 1. Other condition classes are assigned numbers sequentially at the time each condition class is delineated.

On a plot, each sampled condition class must have a unique number that can change at remeasurement to reflect new conditions on the plot.
CONDITION CLASS NUMBER is independent of SUBPLOT NUMBER.

When collected: All condition classes
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values: 1 to 9

5.5.2 CONDITION CLASS STATUS (CORE 2.4.2) [COND_STATUS_CD]

Record the code that describes the sampling status of the condition class. The instructions in Sections 5.2 and 5.3 apply when delineating condition classes that differ by CONDITION CLASS STATUS. In situations where a condition is denied access or hazardous, but obviously contains no forest land, record CONDITION CLASS STATUS = 2, 3 or 4. In cases where a condition is access-denied or hazardous land use and has the possibility of forest, record CONDITION CLASS STATUS = 5.

When collected: All condition classes
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values:

1. Accessible forest land *(see definition on page 60)*
2. Nonforest land
3. Noncensus water
4. Census water
5. Nonsampled – possibility of forest land

5.5.3 PREVIOUS CONDITION CLASS STATUS (PNW) [PREV_COND_STATUS_CD_PNWRS]

Downloaded code indicating sampling status of the condition class recorded at the previous inventory. Do not change the downloaded code.

When collected: Downloaded code when SAMPLE KIND = 2
Field width: 1 digit
Tolerance: No errors
MQO: N/A
Values:

1. Accessible forest land *(see definition on page 60)*
2. Nonforest land
3. Noncensus water
4. Census water
5. Nonsampled – possibility of forest land

5.5.4 NONFOREST CONDITION CLASS STATUS (CORE 2.4.4) [NF_COND_STATUS_CD]

Record the code that describes the sampling status of the condition class (see the nonforest nonsampled reasons below for additional information).

When collected: When CONDITION CLASS STATUS = 2 and NONFOREST SAMPLING STATUS = 1
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values:

2	Accessible nonforest land
5	Nonsampled nonforest

5.5.5 NONFOREST CONDITION NONSAMPLED REASON (CORE 2.4.5) [NF_COND_NONSAMPLE_REASN_CD]

For portions of plots that are nonforest land and can not be sampled (NONFOREST CONDITION CLASS STATUS = 5), record one of the following reasons. **In the Hawaiian Islands this will only be collected on Experimental Forest Lands. Other lands in Hawaii NONFOREST SAMPLING STATUS = 0.**

When collected: When CONDITION CLASS STATUS = 2 and NONFOREST SAMPLING STATUS = 1 and NONFOREST CONDITION STATUS = 5.

Field width: 2 digits
Tolerance: No errors
MQO: At least 99% of the time
Values:

02	Denied access – Any area within the sampled area of a plot to which access is denied by the legal owner, or to which an owner of the only reasonable route to the plot denies access. There are no minimum area or width requirements for a condition class delineated by denied access. Because a denied-access condition can become accessible in the future, it remains in the sample and is re-examined at the next occasion to determine if access is available.
03	Hazardous situation – Any area within the sampled area on plot that cannot be accessed because of a hazard or danger, for example cliffs, quarries, strip mines, illegal substance plantations, temporary high water, etc. Although the hazard is not likely to change over time, a hazardous condition remains in the sample and is re-examined at the next occasion to determine if the hazard is still present. There are no minimum size or width requirements for a condition class delineated by a hazardous condition.
10	Other – This code is used whenever a condition class is not sampled due to a reason other than one of the specific reasons listed. A field note is required to describe the situation.

5.5.6 NONFOREST CONDITION CLASS SAMPLING STATUS (PNW) [NF_COND_SAMPLE_STATUS_CD_PNWRS]

Record a code that indicates whether this nonforest condition (CONDITION CLASS STATUS = 2) is part of a nonforest inventory. When a nonforest condition is within Experimental Forest boundaries, land meeting the accessible nonforest land definition that also has vascular vegetation cover greater is considered a measurable nonforest condition class (NONFOREST CONDITION CLASS SAMPLING STATUS = 1). Certain data items are recorded in NONFOREST CONDITION CLASS SAMPLING STATUS = 1 conditions which are not typically measured in nonforest conditions; these are identified in the associated "when collected" field for individual data items.

When collected: When NONFOREST CONDITION CLASS STATUS = 2
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values:

0	Nonforest conditions are not inventoried
1	Nonforest conditions are inventoried (only when condition falls on Experimental Forest land and vascular vegetation cover is greater than or equal to 10 percent).

5.6 Accessible Forest Land Delineating Data Items

Data items described in this subsection determine if accessible forest land qualifies to be subdivided into separate condition classes, with the exception of PREVIOUS OWNER GROUP. Section 5.1, Determination of Condition Class, applies when delineating contrasting forest condition classes based on these data items.

5.6.1 RESERVED STATUS (Core 2.5.1) [RESERVECD]

Record the code that identifies the reserved designation for the condition. Reserved land is withdrawn by law(s) prohibiting the management of land for the production of wood products (not merely controlling or prohibiting wood-harvesting methods). Such authority is vested in a public agency or department, and supersedes rights of ownership. The prohibition against management for wood products cannot be changed through decision of the land manager (management agency) or through a change in land management personnel, but rather is permanent in nature.

The phrase "withdrawn by law" includes as reserved land, parcels of private land with deeds that specifically prohibit the management of the tract for the production of wood products.

Note: the value of this data item may be downloaded (at least for condition class 1) for all plots. However, when field visited, check to be sure the value is correct for the condition.

When collected: All Plots (CONDITION CLASS STATUS is not null)
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values:

0	Not reserved
1	Reserved

5.6.2 OWNER GROUP (CORE 2.5.2) [OWNGRPCD]

Record the OWNER GROUP code identifying the ownership (or the managing Agency for public lands) of the land in the condition class. Conditions will be delineated based on changes in OWNER GROUP only; separate conditions due to changes in OWNER GROUP are recognized only where differences can be clearly identified on the ground when visiting the plot.

When collected: All accessible forest land condition classes (CONDITION CLASS STATUS = 1) and nonforest land condition classes (CONDITION CLASS STATUS 2 or 5)
Field width: 2 digit
Tolerance: No errors
MQO: At least 99% of the time
Values:

10	Forest Service
20	Other Federal
30	State and Local Government
40	Private

5.6.3 PREVIOUS OWNER GROUP (PNW) [PREV_OWNGRPCD_PNWRS]

On remeasurement plots this item will be populated directly from the previous visits OWNER GROUP data item. Examine the PREVIOUS OWNER GROUP field and determine if it was correctly coded at the previous visit. **If the OWNER GROUP of the condition actually changed, do not update this field**; change will be captured by comparing OWNER GROUP at the prior visit to OWNER GROUP at the current visit. If the OWNER GROUP recorded at the previous inventory (i.e., PREVIOUS OWNER GROUP) was coded incorrectly use codes 10 through 40 to correct the downloaded code (indicating an error was made at the previous visit). An update to this field requires an explanatory note in the electronic CONDITION CLASS NOTES.

When collected: Downloaded when SAMPLE KIND = 2
Field width: 2 digit
Tolerance: No errors
MQO: At least 99% of the time
Values:

10	PREVIOUS OWNERSHIP GROUP should be 10 (Forest Service)
20	PREVIOUS OWNERSHIP GROUP should be 20 (Other Federal)
30	PREVIOUS OWNERSHIP GROUP should be 30 (State and Local Government)
40	PREVIOUS OWNERSHIP GROUP should be 40 (Private)

5.6.4 FOREST COMMUNITY (HAWAII – based on core FOREST TYPE) [FOREST COMMUNITY_PNWRS]

Record the code corresponding to the FOREST COMMUNITY that best describes the vegetation in each forested condition class. These FOREST COMMUNITIES are taken from Mueller-Dombois and Fosberg, 1998.

The instructions in Sections 5.1 and 5.3 apply when delineating, within accessible forest land, contrasting conditions based on differences in FOREST COMMUNITY.

If STAND SIZE CLASS is nonstocked, then FOREST COMMUNITY is determined by the following:

For SAMPLE KIND = 2 plots, record the FOREST COMMUNITY of the condition at the previous inventory.

For all other plots:

Evaluate any surrounding area and adjacent stands to determine the FOREST COMMUNITY. Use your best professional judgment to determine FOREST COMMUNITY.

When collected: All accessible forest land or condition classes (CONDITION STATUS = 1)
Field width: 2 digits
Tolerance: No errors in group or type
MQO: At least 99% of the time in group; at least 95% of the time in type
Values:

1 Strand or halophytic vegetation - vegetation near the shore containing species adapted to high rates of evaporation by wind and to high salt concentrations from windblown ocean spray or inundation by salt water

2 Mangrove swamps – trees with high salt tolerance growing on tidally inundated shores and in landlocked depressions. Many species have pneumatophores, adaptive structures for aeration of waterlogged root systems.

3 Lowland tropical rainforest – multistoried forest with many canopy-dwelling epiphytes, open ground, and shrub layers. This forest community can extend up the lower slopes with windward rainy exposures

4 Montane rainforest –the predominant type on moist hilltops and mountain slopes in many tropical islands. Forests of low stature that are rich in shrubs and epiphytes.

5 Cloud forest - These forests are covered with clouds or fog much of the time. The trees have low canopies and are often dripping with moisture. The trees are typically small-leafed and covered with masses of epiphytic mosses and liverworts, which also form a deep ground cover.

6 Mesophytic or moist forest – seasonally dry evergreen forests on leeward, drier slopes.

7 Xerophytic – forests found on truly dry, rain-shadow, leeward mountain slopes and lowlands

8 Agroforestry – tree species are included in crop or animal production agricultural ecosystems

9 Plantations – an area planted with tree species for the purpose of timber production. Species planted are mainly eucalypt, mahogany, and pine species that replace indigenous forests and savannas.

5.6.5 STAND SIZE CLASS (CORE 2.5.4) [FSLSZCD]

Record the code that best describes the predominant size class of all live trees in the condition class.

When collected: All accessible forest land condition classes (CONDITION CLASS STATUS = 1)
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values:

0 Nonstocked:
Meeting the definition of accessible forest land, and less than 10 percent **crown cover** of trees of any size.

1 < 5.0 in (seedlings / saplings)
At least 10 percent crown cover in trees of any size; and at least 2/3 of the crown cover is in trees less than 5.0 in DBH.

2 5.0 – 8.9 in (softwoods) / 5.0 – 10.9 in (hardwoods)
At least 10 percent crown cover in trees of any size; and at least 1/3 of the crown cover is in trees greater than or equal to 5.0 in DBH **and** the plurality of the crown cover is in softwoods between 5.0 – 8.9 in diameter and/or hardwoods between 5.0 – 10.9 in DBH..

3 9.0 – 19.9 in (softwoods) / 11.0 – 19.9 in (hardwoods)
At least 10 percent crown cover in trees of any size; and at least 1/3 of the crown cover is in trees greater than or equal to 5.0 in DBH **and** the plurality of the crown cover is in softwoods between 9.0 – 19.9 in diameter and/or hardwoods between 11.0 – 19.9 in DBH.

4 20.0 – 39.9 in
At least 10 percent crown cover in trees of any size; and at least 1/3 of the crown cover is in trees greater than or equal to 5.0 in DBH **and** the plurality of the crown cover is in trees between 20.0 – 39.9 in DBH.

5 40.0 + in
At least 10 percent crown cover in trees of any size; and at least 1/3 of the crown cover is in trees greater than or equal to 5.0 in DBH **and** the plurality of the crown cover is in trees $\geq$ 40.0 in DBH.

6 Cover trees (trees not on species list, used for plots classified as nonforest):
Less than 10 percent crown cover by trees of any size, and greater than 10 percent **crown cover** of species that comprise cover trees.

The instructions in Sections 5.1 and 5.3 apply when delineating, on accessible forest land, contrasting conditions based on differences in STAND SIZE CLASS.

Within the sampled area on microplot or subplot recognize only very obvious contrasting stands of different mean diameter with an abrupt boundary. Example: an obvious abrupt boundary exists within the sampled (fixed-radius) area of a subplot and demarcates a large diameter stand from a small diameter stand. Use tree crown cover of all live trees that are not overtopped to differentiate between stand-size classes.

Use crown cover as the surrogate for stocking to determine STAND SIZE CLASS. View the plot from the top down and examine crown cover. The stand must have at least 10 percent of the crown cover in STAND SIZE CLASSES of 1, 2, 3, 4, or 5 or any combination of these STAND SIZE CLASSES; otherwise the STAND SIZE CLASS is 0. If 2/3 of the crown cover is STAND SIZE CLASS = 1, classify the condition as STAND SIZE CLASS = 1. If less than 2/3 of the crown cover is STAND SIZE CLASS = 1, classify the condition as STAND SIZE CLASS = 2, 3, 4, or 5, based on which of these STAND SIZE CLASSES has the most crown cover.

5.6.6 REGENERATION STATUS (CORE 2.5.5) [STDORGCD]

Record the code that best describes the artificial regeneration that occurred in the condition.

The instructions in Sections 5.1 and 5.3 apply when delineating, within accessible forest land, contrasting conditions based on differences in REGENERATION STATUS.

For a forest land condition to be delineated and/or classified as artificially regenerated, the condition must show distinct evidence of planting or seeding. If it is difficult to determine whether or not a stand has been planted or seeded, then use code 0. If no distinct boundary exists within the sampled (fixed-radius) area on any subplot, then do not recognize separate conditions. In many regions of the West, trees are not planted in rows, and planted stands do not differ in physical appearance from natural conditions. In these cases, there is no need to differentiate conditions based on stand origin.

Note: Plot records or verbal evidence from landowner is acceptable for determining regeneration status.

When collected: All accessible forest land condition classes (CONDITION CLASS STATUS = 1)
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values:

0 Natural Present stand shows no clear evidence of artificial regeneration. Includes unplanted, recently cut lands.

1 Artificial Present stand shows clear evidence of artificial regeneration.

5.6.7 TREE DENSITY (CORE 2.5.6) [MAPDEN]

Record a code to indicate the relative tree density classification. Base the classification on the number of stems/unit area, basal area, tree cover, or stocking of all live trees in the condition that are not overtopped, compared to any previously defined condition class TREE DENSITY.

The instructions in Sections 5.1 and 5.3 apply when delineating, within accessible forest land, contrasting conditions based on differences in TREE DENSITY.

Codes 2 and higher are used ONLY when all other attributes used to delineate separate condition classes are homogenous, i.e., when a change in density is the ONLY difference within what would otherwise be treated as only one forest condition. Otherwise, code 1 for all condition classes. Codes 2 and higher are usually, but not always, used to demarcate areas that differ from an adjacent area due to forest disturbance, e.g., a partial harvest or heavy, but not total tree mortality due to a ground fire. Delineation by density should only be done when the less-dense condition is 50 percent or less as dense as the more dense condition.

Do not distinguish between low-stocked stands or stands of sparse and patchy forest.

In order to qualify as a separate condition based on density, there MUST be a distinct, easily observed change in the density of an area's tree cover or basal area.

Examples of valid contrasting conditions defined by differences in tree density are:

- the eastern half of an otherwise homogeneous, 20-acre stand has many trees killed by a bark beetle outbreak,
- one portion of a stand is partially cut over (with 40 square feet basal area per acre) while the other portion is undisturbed (with 100 square feet basal area per acre).

NOTE: In these examples, RESERVED STATUS, OWNER GROUP, FOREST COMMUNITY, STAND SIZE CLASS, and REGENERATION STATUS are the same.

When collected: All accessible forest land condition classes (CONDITION CLASS STATUS = 1)
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values:

1 Initial density class
2 Density class 2 - density different than 1
3 Density class 3 - density different than 1 and 2

5.7 Ancillary (Non-Delineating) Data Items

5.7.1 OWNER CLASS (CORE 2.5.7) [OWNCD_PNWRS]

Record the OWNER CLASS code that best corresponds to the ownership (or the managing Agency for public lands) of the land in the condition class. Conditions will **NOT** be delineated based on changes in owner class. If multiple owner classes within a group occur on a single condition class, record the owner class closest to the plot center.

Note: When federal land is owned and administered by two separate entities (e.g., BLM and Forest Service), this data item records the legal owner of the land, not the administrator.

When collected: All accessible forest land (CONDITION CLASS STATUS =1) and nonforest land condition classes (CONDITION STATUS = 2 or 5)
Field width: 2 digits
Tolerance: No errors
MQO: At least 99% of the time
Values:

Owner Classes within Forest Service Lands (Owner Group 10):

11 National Forest
12 National Grassland
13 Other Forest Service

Owner Classes within Other Federal Lands (Owner Group 20)

21 National Park Service
22 Bureau of Land Management
23 Fish and Wildlife Service
24 Departments of Defense/Energy
25 Other Federal

Owner Classes within State and Local Government lands (Owner Group 30)

31 State
32 Local (County, Municipality, etc.)
33 Other Non Federal Public
34 *Village or communal property* (Regional)

Owner Classes within Private lands (Owner Group 40)

41 Corporate
42 Non Governmental Conservation / Natural Resources Organization - examples: Nature Conservancy, National Trust for Private Lands, Pacific Forest Trust, Boy Scouts of America, etc.
43 Unincorporated Partnerships / Associations / Clubs – examples: Hunting Clubs that **own, not lease** property, recreation associations, 4H, etc.
44 Native American (Indian) – within reservation boundaries
45 Individual

5.7.2 PRIVATE OWNER INDUSTRIAL STATUS (CORE 2.5.8) [FORINDCD]

Code identifying the status of the owner with regard to being considered industrial as determined by whether or not they own and operate a primary wood processing plant. A primary wood processing plant is any commercial operation which originates the primary processing of wood on a regular and continuing basis. Examples include: pulp or paper mill, sawmill, panel board mill, post or pole mill, etc. Cabinet shops, "mom & pop" home-operated businesses, etc., should not be considered as industrial plants. If any doubt exists with the determination by the field crew about the owner's industrial status due to name, commercial plant size, type plant, etc., choose code 0. *It has been determined that none of the Hawaii landowners are classified as industrial owners so this code should always equal 0.*

NOTE: FIA unit or State headquarters may have to maintain a list of recognized industrial owners within a State for crews to use when making these determinations.

When collected: *Auto-populated as 0 for* all accessible forest land condition classes (CONDITION CLASS STATUS = 1) when the OWNER GROUP is private (OWNER GROUP 40)

Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values:
0 Land **is not** owned by industrial owner with a wood processing plant
1 Land **is** owned by industrial owner with wood processing plant

5.7.3 ARTIFICIAL REGENERATION SPECIES (CORE 2.5.9) [STDORGSP]

Record the species code of the predominant tree species for which evidence exists of artificial regeneration in the stand. This attribute is ancillary; that is, contrasting condition classes are never delineated based on variation in this attribute.

When collected: All accessible forest land condition classes (CONDITION CLASS STATUS = 1) with evidence of artificial regeneration (REGENERATION STATUS = 1)

Field width: 4 digits
Tolerance: No errors
MQO: At least 99% of the time
Values: See Appendix 1 (Tree Species List, page 199)

5.7.4 STAND AGE (CORE 2.5.10) [STANDAGE_PNWRS]

Record the average total age, to the nearest year, of the trees (plurality of all live trees not overtopped) in the predominant STAND SIZE CLASS of the condition, determined using local procedures. Record 000 for nonstocked stands.

The crew botanist should be able to provide an estimate of stand age given that the trees in the stand originated at approximately the same time. In tropical forests, the continuous process of gap phase dynamics often prevails, where individuals die, form a gap, and are replaced by lower-canopy individuals. Often you cannot determine stand age in stands that are not characterized by stand replacing disturbance. The trees on typhoon-prone islands would be expected to re-initiate growth following disturbance at approximately the same time.

An estimate of STAND AGE is required for every forest land condition class defined on a plot. Stand age is usually highly correlated with stand size and should reflect the average age of all trees that are not overtopped. Estimates of stand age should estimate the time of tree establishment (e.g., not age at the point of diameter measurement). Note: For planted stands, estimate age based on the year the stand was planted (e.g., do not add in the age of the planting stock).

Developmental stage and known dates of disturbance are likely to be the only guides to estimating stand age.

If continuous tree replacement by gap phase dynamics appears to characterize a stand, record code 996.

Record 997 if this appears unworkable, but please, do the best you can.

If a condition class is nonstocked, assign a STAND AGE of 000.

When collected: All accessible forest land condition classes (CONDITION CLASS STATUS = 1)
Field width: 3 digits
Tolerance: +/- 10%
MQO: At least 95% of the time
Values: 000 to 995 (actual stand age estimate), 996 (gap phase dynamics (regional)), 997 (unable to get a reasonable estimate (regional))

5.7.5 DOMINANT TREE SPECIES 1 (HAWAII) [DOMINANT SPECIES1_PNWRS]

Record the code corresponding to the TREE SPECIES (Appendix 1, page 199) with the plurality of stocking for all live trees in the condition class that are not overtopped.
For example, if a forested condition class contains 30% species A, 30% species B, and 40 % species C, then the DOMINANT TREE SPECIES will be the code for species C.

When collected: All accessible forest land condition classes (CONDITION CLASS STATUS = 1)
Field width: 4 digits
Tolerance: no errors
MQO: At least 95% of the time
Values: See Appendix 1 (Tree Species List, page 199)

5.7.6 DOMINANT TREE SPECIES 2 (HAWAII) [DOMINANT SPECIES2_PNWRS]

Record the code for the second most abundant tree species in each condition class.
See Dominant Tree Species 1 for coding instructions. If a second species does not exist, record 0000.

When collected: All accessible forest land condition classes (CONDITION CLASS STATUS = 1)
Field width: 4 digits
Tolerance: no errors
MQO: At least 95% of the time
Values: See Appendix 1 (Tree Species List, page 199), 0000 (no second tree species present)

5.7.7 DOMINANT TREE SPECIES 3 (HAWAII) [DOMINANT SPECIES3_PNWRS]

Record the code for the third most abundant tree species in each condition class
See Dominant Tree Species 1 for coding instructions. If a third species does not exist, record 0000.

When collected: All accessible forest land condition classes (CONDITION CLASS STATUS = 1)
Field width: 4 digits
Tolerance: no errors
MQO: At least 95% of the time
Values: See Appendix 1 (Tree Species List, page 199), 0000 (no third species present)

5.7.8 DISTURBANCE 1 (CORE 2.5.11) [DSTRBCD1_PNWRS]

Record the code corresponding to the presence of the following disturbances. Disturbance can c onnote positive or negative effects. The area affected by any natural or human-caused disturbance must be at least 1.0 acre in size. Record up to three different disturbances per condition class from most important to least important. This attribute is ancillary; that is, contrasting conditions are never delineated based on variation in this attribute.

For initial plot establishment (SAMPLE KIND =1 or 3), the disturbance must be within the last 5 years. For remeasured plots recognize only those disturbances that have occurred since the previous inventory.

Disturbance codes require "significant threshold" damage, which implies mortality and/or damage to 25 percent of all trees in a stand or 50 percent of an individual species' count. Additionally, some disturbances affect land and/or vegetation, but initially may not affect vegetation growth or health (e.g., grazing, browsing, flooding, etc.). In these cases, a disturbance should be coded when at least 25 percent of the soil surface or understory vegetation has been affected.

Use the general disturbance codes (i.e. 10, 20, etc) only if one of the more specific codes (i.e., 41, 42, etc) does not apply. When coding fire (30) it is important to distinguish ground fire (31) from crown fire (32) where possible. Code “00” if no DISTURBANCE 1 is observed.

When collected: All accessible forest land condition classes (CONDITION CLASS STATUS = 1) or accessible nonforest condition classes when nonforest is being sampled (NONFOREST SAMPLING STATUS = 1 and CONDITION CLASS STATUS = 2 and NONFOREST CONDITION CLASS STATUS = 2)

Field width: 2 digits
Tolerance: No errors
MQO: At least 99% of the time

Values:

Code Definition
- 00 None - no observable disturbance
- 10 Insect damage
  - 11 insect damage to understory vegetation
  - 12 insect damage to trees, including seedlings and saplings
- 20 Disease damage
  - 21 disease damage to understory vegetation
  - 22 disease damage to trees, including seedlings and saplings
- 30 Fire (from crown and ground fire, either prescribed or natural)
  - 31 ground fire
  - 32 crown fire
- 40 Animal damage
  - 41 beaver (includes flooding caused by beaver)
  - 42 porcupine
  - 43 deer/ungulate
  - 44 bear
  - 45 rabbit
  - 46 domestic animal/livestock (includes grazing):
  - 47 pigs, wild boars
- 50 Weather damage
  - 51 ice
  - 52 wind (includes typhoon, hurricane, tornado)
  - 53 flooding (weather induced)
  - 54 drought
  - 56 erosion
- 60 Vegetation (suppression, competition, vines)
- 70 Unknown / not sure / other (include in NOTES)
- 80 Human-caused damage – any significant threshold of human-caused damage not described in the DISTURBANCE codes listed above or in the TREATMENT codes listed below. Must include a plot-level note to describe further.
- 90 Geologic disturbances
  - 91 landslide
  - 92 avalanche track
  - 93 volcanic blast zone
  - 94 other geologic event
  - 95 earth movement/avalanches

5.7.9 DISTURBANCE YEAR 1 (CORE 2.5.12) [DSTRBYR1]

Record the year in which DISTURBANCE 1 occurred. If the disturbance occurs continuously over a period of time, record 9999.

When collected: When DISTURBANCE 1 > 00
Field width: 4 digits
Tolerance: +/- 1 year for measurement cycles of 5 years
+/- 2 years for measurement cycles of > 5 years
MQO: At least 99% of the time
Values: Year that is the same as or since the previous inventory plot visit, or with the past 5 years for plots visited for the first time; 9999

5.7.10 DISTURBANCE 2 (CORE 2.5.13) [DSTRBCD2_PNWRS]

If a stand has experienced more than one disturbance, record the second disturbance here. See DISTURBANCE 1 for coding instructions. Code “00” if no DISTURBANCE 2 is observed.

5.7.11 DISTURBANCE YEAR 2 (CORE 2.5.14) [DSTRBYR2]

Record the year in which DISTURBANCE 2 occurred. See DISTURBANCE YEAR 1 for coding instructions.

5.7.12 DISTURBANCE 3 (CORE 2.5.15) [DSTRBCD3_PNWRS]

If a stand has experienced more than two disturbances, record the third disturbance here. See DISTURBANCE 1 for coding instructions. Code "00" if no DISTRUBANCE 3 is observed.

5.7.13 DISTURBANCE YEAR 3 (CORE 2.5.16) [DSTRBYR3]

Record the year in which DISTURBANCE 3 occurred. See DISTURBANCE YEAR 1 for coding instructions.

5.7.14 TREATMENT 1 (CORE 2.5.17) [TRTCD]

Forestry treatments are a form of disturbance. These human disturbances are recorded separately here for ease of coding and analysis. The term treatment further implies that a silvicultural application has been prescribed. This does not include occasional stumps of unknown origin or sparse removals for firewood, Christmas trees, or other miscellaneous purposes. The area affected by any treatment must be at least 1.0 acre in size. Record up to three different treatments per condition class from most important to least important as best as can be determined. This attribute is ancillary; that is, contrasting conditions are never delineated based on variation in this attribute.

For initial plot establishment (SAMPLE KIND = 1 or 3), the treatment must be within the last 5 years. For remeasured plots recognize only those treatments that have occurred since the previous inventory.

When collected: All accessible forest land condition classes (CONDITION CLASS STATUS = 1) or accessible nonforest condition classes when nonforest is being sampled (NONFOREST SAMPLING STATUS = 1 and CONDITION CLASS STATUS = 2 and NONFOREST CONDITION CLASS STATUS = 2)

Field width: 2 digits
Tolerance: No errors
MQO: At least 99% of the time
Values:

Code	Definition
00	None - No observable treatment.
10	Cutting - The removal of one or more trees from a stand.
20	Site preparation - Clearing, slash burning, chopping, disking, bedding, or other practices clearly intended to prepare a site for either natural or artificial regeneration.
30	Artificial regeneration - Following a disturbance or treatment (usually cutting), a new stand where at least 50% of the live trees present resulted from planting or direct seeding.
40	Natural regeneration - Following a disturbance or treatment (usually cutting), a new stand where at least 50% of the live trees present (of any size) were established through the growth of existing trees and/or natural seeding or sprouting.
50	Other silvicultural treatment - The use of fertilizers, herbicides, girdling, pruning, or other activities (not covered by codes 10-40) designed to improve the commercial value of the residual stand, or chaining, which is a practice used on woodlands to encourage wildlife forage

5.7.15 TREATMENT YEAR 1 (CORE 2.5.18) [TRTYR1]

Record the year in which TREATMENT 1 occurred.

> When collected: When TREATMENT 1 > 00
> Field width: 4 digits
> Tolerance: +/- 1 year for measurement cycles of 5 years
> +/- 2 years for measurement cycles of > 5 years
> MQO: At least 99% of the time
> Values: Year that is the same or since the previous inventory plot visit, or within the past five years for plots visited for the first time

5.7.16 TREATMENT 2 (CORE 2.5.19) [TRTCD2]

If a stand has experienced more than one treatment, record the second treatment here. See TREATMENT 1 for coding instructions. Code "00" if no TREATMENT 2 is observed.

5.7.17 TREATMENT YEAR 2 (CORE 2.5.20 [TRTYR2]

Record the year in which TREATMENT 2 occurred. See TREATMENT YEAR 1 for coding instructions.

5.7.18 TREATMENT 3 (CORE 2.5.21) [TRTCD3]

If a stand has experienced more than two treatments, record the third treatment here. See TREATMENT 1 for coding instructions. Code "00" if no TREATMENT 3 is observed.

5.7.19 TREATMENT YEAR 3 (CORE 2.5.22) [TRTYR3]

Record the year in which TREATMENT 3 occurred. See TREATMENT YEAR 1 for coding instructions.

5.7.20 CONDITION CLASS SLOPE (HAWAII) [SLOPE]

Record a 3-digit code indicating the average slope percent of the condition within the plot area. Use the slope percentages recorded by subplot as one aid to determine slope by condition class average.

> When collected: All accessible forest land condition classes (CONDITION CLASS STATUS = 1) or accessible nonforest condition classes when nonforest is being sampled (NONFOREST SAMPLING STATUS = 1 and CONDITION CLASS STATUS = 2 and NONFOREST CONDITION CLASS STATUS = 2)
>
> Field width: 3 digits
> Tolerance: +/- 10%
> MQO: At least 90% of the time
> Values: 000 to 155

5.7.21 CONDITION CLASS ASPECT (HAWAII) [ASPECT]

Record a 3-digit azimuth indicating the direction of slope for the land surface of the condition class. Use the aspects recorded by subplot as one aid to determine aspect by condition class. If the aspect is equally SE, S, SW, code the azimuth of the S aspect. If the aspect is SE, S, SW, but 80 percent of the condition class is SE, code the azimuth of the SE aspect.

> When collected: All accessible forest land condition classes (CONDITION CLASS STATUS = 1) or accessible nonforest condition classes when nonforest is being sampled (NONFOREST SAMPLING STATUS = 1 and CONDITION CLASS STATUS = 2 and NONFOREST CONDITION CLASS STATUS = 2)
>
> Field width: 3 digits
> Tolerance: +/- 10 degrees
> MQO: At least 90% of the time

Values:

000 no aspect, slope < 5 percent
001 1 degree
002 2 degrees
… …
360 360 degrees, due north

5.7.22 PHYSIOGRAPHIC CLASS (CORE 2.5.23) [PYSCLCD]

Record the code that best describes the PHYSIOGRAPHIC CLASS of the condition within the plot area; land form, topographic position, and soil generally determine physiographic class.

When collected: All accessible forest land condition classes (CONDITION CLASS STATUS = 1) or accessible nonforest condition classes when nonforest is being sampled (NONFOREST SAMPLING STATUS = 1 and CONDITION CLASS STATUS = 2 and NONFOREST CONDITION CLASS STATUS = 2)

Field width: 2 digits
Tolerance: No errors
MQO: At least 80% of the time
Values:

Xeric Sites that are normally low or deficient in moisture available to support vigorous tree growth. These areas may receive adequate precipitation, but experience a rapid loss of available moisture due to runoff, percolation, evaporation, etc.

11 Dry Tops - Ridge tops with thin rock outcrops and considerable exposure to sun and wind.

12 Dry Slopes - Slopes with thin rock outcrops and considerable exposure to sun and wind. Includes most steep slopes with a southern or western exposure.

13 Deep Sands - Sites with a deep, sandy surface subject to rapid loss of moisture following precipitation. Typical examples include sand hills, sites along the beach and shores of lakes and streams, and many deserts.

19 Other Xeric - All dry physiographic sites not already described.

Mesic Sites that have moderate but adequate moisture available to support vigorous tree growth except for periods of extended drought. These sites may be subjected to occasional flooding during periods of heavy or extended precipitation.

21 Flatwoods - Flat or fairly level sites outside flood plains. Excludes deep sands and wet, swampy sites.

22 Rolling Uplands - Hills and gently rolling, undulating terrain and associated small streams. Excludes deep sands, all hydric sites, and streams with associated flood plains.

23 Moist Slopes and Coves - Moist slopes and coves with relatively deep, fertile soils. Often these sites have a northern or eastern exposure and are partially shielded from wind and sun. Includes moist mountain tops and saddles.

24 Narrow Flood plains/Bottomlands - Flood plains and bottomlands less than 1/4-mile in width along rivers and streams. These sites are normally well drained but are subjected to occasional flooding during periods of heavy or extended precipitation. Includes associated levees, benches, and terraces within a 1/4 mile limit. Excludes swamps, sloughs, and bogs.

25 Broad Flood plains/Bottomlands - Flood plains and bottomlands 1/4 mile or wider in width along rivers and streams. These sites are normally well drained but are subjected to occasional flooding during periods of heavy or extended precipitation. Includes associated levees, benches, and terraces. Excludes swamps, sloughs, and bogs with year-round water problems.

29 Other Mesic - All moderately moist physiographic sites not already described.

Hydric Sites that generally have a year-round abundance or over-abundance of moisture. Hydric sites are very wet sites where excess water seriously limits both growth and species occurrence.

31 Swamps / Bogs - Low, wet, flat forested areas usually quite extensive that are flooded for long periods of time except during periods of extreme drought. Excludes cypress ponds and small drains.

32 Small Drains - Narrow, stream-like, wet strands of forest land often without a well-defined stream channel. These areas are poorly drained or flooded throughout most of the year and drain the adjacent higher ground.

33 Bays and wet pocosins - Low, wet, boggy sites characterized by peaty or organic soils. May be somewhat dry during periods of extended drought. Examples include the Carolina bays in the southeast US.

34 Beaver ponds

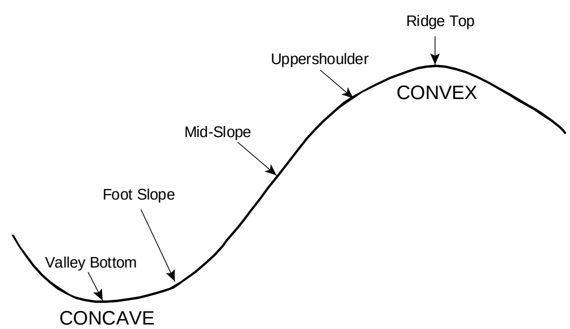
35 Cypress ponds

39 Other hydric - All other hydric physiographic sites.

5.7.23 SLOPE SHAPE (HAWAII) [SLOPE_SHAPE_PNWRS]

Record the slope shape over the condition class under consideration. Use the slope shapes recorded by subplot as **one** aid to determine slope shape by condition class.

When collected: All accessible forest land condition classes (CONDITION CLASS STATUS = 1) or accessible nonforest condition classes when nonforest is being sampled (NONFOREST SAMPLING STATUS = 1 and CONDITION CLASS STATUS = 2 and NONFOREST CONDITION CLASS STATUS = 2)



Field width: 2 digits
Tolerance: No errors
MQO: At least 90% of the time:
Values:

Flat	00
Concave	10
Convex	20

5.7.24 SLOPE POSITION (HAWAII) [SLOPE POSITION PNWRS]

Record the slope position over the condition class under consideration: Use the slope positions recorded by subplot as one aid to determine slope position by condition class.

When collected: All accessible forest land condition classes (CONDITION CLASS STATUS = 1) or accessible nonforest condition classes when nonforest is being sampled (NONFOREST SAMPLING STATUS = 1 and CONDITION CLASS STATUS = 2 and NONFOREST CONDITION CLASS STATUS = 2)

Field width: 2 digits
Tolerance: +/- 1 class for codes 10-30
Other codes – no errors
MQO: At least 90% of the time

Values:

00	=	Flat
10	=	Uppershoulder
20	=	Midslope
30	=	Footslope
40	=	Valleybottom
50	=	Ridgetop

To more accurately measure the moisture-related effects of topography on vegetation, two separate, calculated indices will be computed in the lab from data gathered in the field: 1.) an index of moisture demand and 2.) an index of moisture supply. For moisture demand, the aspect, slope and elevation at each plot is used to approximate annual moisture demand from "Potential Solar Beam Irradiation on Slopes" tables or equations (Frank and Lee 1966). Moisture supply is estimated from an additive, modified, topographic relative moisture index (TRMI; Parker 1982) constructed using slope shape, percent slope and slope position. Higher moisture supply values occur on footslopes, gentle slopes and/or sites exhibiting slope concavities.

5.7.25 PRESENT NONFOREST LAND USE (CORE 2.5.24) [PRESNFCD_PNWRS]

Record this attribute for all nonforest condition classes. For areas that were sampled and classified at last inventory as accessible forest land and are now nonforest land, the area that has changed is a new, separate condition class. It should not be considered part of any nonforest land condition class(es) sampled during the previous inventory that may still be present. Instructions in Sections 5.1 and 5.3 apply. Select the classification for the new nonforest condition that, within sampled area, indicates what the majority of this changed area is now if more than one nonforest classes are present.

Note: Gradations of agroforestry will be present on the islands and will be coded with code 18.

The following paragraph does NOT pertain to the Hawaiian Islands, but rather to the other Pacific Islands Inventories:

On all visited plots with an accessible forest land and grass, forb or shrub land condition classes, map all nonforest condition classes present on the 4-subplot standard layout. Do not combine nonforest condition classes present. Example: if nonforest – urban land and nonforest – cropland are both present within a 24 ft radius subplot, map each land class as a separate condition class.

When collected: Current CONDITION CLASS STATUS = 2.
Field width: 2 digits
Tolerance: No errors
MQO: At least 99% of the time
Values:

10 Agricultural land - Land managed for crops, pasture, or other agricultural use. The area must be at least 1.0 acre in size and 120.0 feet wide (with the exception of windbreak/shelterbelt, which has no minimum width.) Use the 10 code only for cases not better described by one of the following:

- 11 Cropland
- 12 Pasture (improved through cultural practices)
- 13 Idle farmland
- 14 Orchard

- 15 Christmas tree plantation
- 16 Maintained wildlife opening
- 17 Windbreak/Shelterbelt
- 18 Low density agro-forest (agro-forest with less than 10 percent cover of tree species)

20 Rangeland - Land primarily composed of grasses, forbs, or shrubs. This includes lands vegetated naturally or artificially to provide a plant cover managed like native vegetation and does not meet the definition of pasture. The area must be at least 1.0 ac in size and 120.0 ft wide.

- 21 Grass lands – dominant vegetation is grasses, including *Miscanthus floridulus, Pennisetum polystachion, Saccharum spontaneum, Sporobolus diander, Eragrostis spp., Digitaria spp, and Cenchrus echinatus*
- 22 Montane grassland/savannah – found on mountains that reach above the heavy cloud belt. Mostly grassland mixed with xerophytic shrubs and small trees
- 23 Montane bogs – sedges, grasses and reeds growing at elevations where they are covered with clouds or fog most of the time. These bogs are on gently sloping or level areas with impeded drainage.
- 24 Alpine vegetation – dwarfed vegetation of grasses and cushion-plants growing at high altitudes
- 25 Fernland – dense tangles of *Dicranopteris* growing on steep slopes usually below 600 m (1,900 ft)
- 26 Subxerophytic/sclerophyllous scrub – vegetation found on truly dry, rain-shadow, leeward mountain slopes and lowlands, consisting of primarily shrub species

30 Developed - Land used primarily by humans for purposes other than forestry or agriculture. Use the 30 code only for land not better described by one of the following:

- 31 Cultural: business (industrial/commercial), residential, and other places of intense human activity.
- 32 Rights-of-way: improved roads, railway, power lines, maintained canal
- 33 Recreation: parks, skiing, golf courses
- 34 Mining

40 Other - Land parcels greater than 1.0 acre in size and greater than 120.0 feet wide, which do not fall into one of the uses described above. Examples include undeveloped beaches, barren land (rock, sand), marshes, bogs, ice, and snow. Use the 40 code only for cases not better described by one of the following.

- 41 Naturally nonvegetated: Barren rock, sand, lava, glaciers
- 42 Wetland
- 43 Beach
- 45 Nonforest Chaparral

5.7.26 CANOPY COVER SAMPLE METHOD (CORE 2.5.25) [CANOPY_CVR_SAMPLE_METHOD_CODE]

Record the CANOPY COVER SAMPLE METHOD used to determine LIVE CANOPY COVER, LIVE PLUS MISSING CANOPY COVER, and TOTAL STEMS for the condition. If the ocular method is not used, the appropriate plot-based method should be selected according to the condition's dimensions and shape.

Ocular method - The Ocular method is only used in areas that are obviously 0 % LIVE PLUS MISSING CANOPY COVER or obviously greater than 10% LIVE PLUS MISSING CANOPY COVER. In addition to visual inspections of what is on the ground, crews can also use various types of aerial imagery to help determine LIVE CANOPY COVER and LIVE PLUS MISSING CANOPY COVER values using this method. The Ocular method may also be used on condition status 2 plots were access to the nonforest landcover area may be limited or the nonforest condition is a developed non-forest land use. Note that when the Ocular method is used, it is likely to be easier for the observer to ignore subplot boundaries and assess the percentage of tree canopy cover over the condition in question, without regard to the locations of the stems supporting the canopy over the plot.

Subplot method - The Subplot method is used when the ocular method is not appropriate and in cases where the terrain, vegetation, and dimensions of a condition or the size of the field crew DO NOT allow a safe or practical sample using the acre method.

1. To estimate cover using the subplot method, the crew measures the crowns of all live trees, seedlings, and saplings on each of the four 1/24 acre subplots. To estimate total stems per acre, stems >5.0 inches diameter are counted on the subplots and stems <5.0 inches diameter are counted only on the four 1/300 acre microplots located 90 degrees and 12.0 feet from the subplot centers. The sample may consist of any combination of regular subplots and/or phantom subplots, provided all subplots fall entirely in the questionable condition.

2. Install phantom subplots as necessary to yield four 1/24-acre sample areas that fall entirely within the questionable condition. Record the location of these phantom or temporary subplots on your four point plot sketch and monument. Establish phantom plots using the following protocol (fig. 15):

    a. Begin by locating the phantom subplots using the "highest" numbered regular subplot that falls in the questionable condition (e.g., 4 is the highest numbered regular subplot, next 3 and then 2). The phantom subplots are located in the following fashion: 1) 120.0 feet at 360 degrees, 2) 120.0 feet at 120 degrees, then 3) 120.0 feet at 240 degrees.
    b. If this fails to yield 4 subplots that fall entirely within the questionable condition, install the remaining phantom subplots off the next highest numbered regular subplot that falls in the questionable condition.
    c. If this fails to produce a suitable location, rotate the phantom subplot off the other phantom subplots in the attempted order of installation until 4 subplots have been located in the questionable condition.

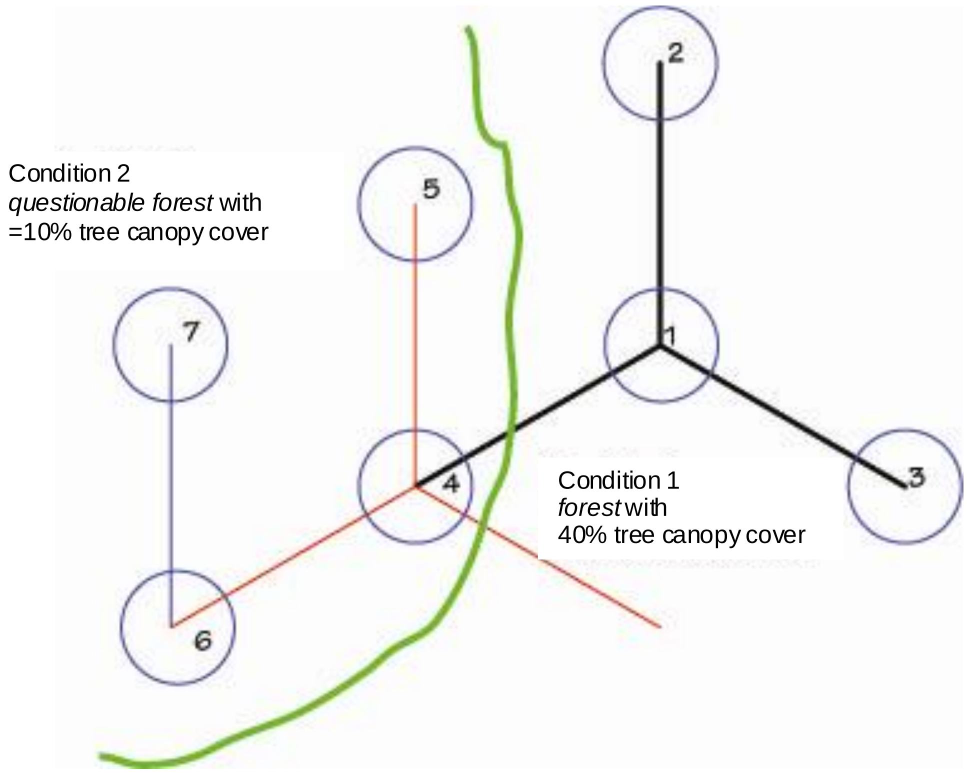


Figure 15. Example of the subplot method phantom subplots.

3. The Subplot method uses a 1/6-acre sample, so it would require a total of 726 ft^2 of LIVE PLUS MISSING CANOPY COVER to reach 10% threshold and be sampled as accessible forestland. If the sample of the subplot method does not reach the 10% threshold for LIVE PLUS MISSING CANOPY COVER, the stem counts are used to determine if there are 200 live stems per acre. Stem counts on the subplot and micro plot have to meet the following tally combinations to be sampled as accessible forestland (assuming 4 subplots and microplots are used):

Microplot Count (<5.0 inch DIA)	Subplot Count (≥5.0 inch DIA)	Estimated Stems per Acre
3	0	225
2	9	204
1	21	201
0	34	204

Acre method - The Acre method is used when the ocular method is not appropriate and when it is safe and practical to sample on the entire acre.

1. To determine if minimum 10% LIVE PLUS MISSING CANOPY COVER is reached (4356 sq ft), the crew samples all live, dead, and missing tree canopies on the one-acre sample plot (117.75 foot radius) as described above in LIVE PLUS MISSING CANOPY COVER.

2. If the 10% LIVE PLUS MISSING CANOPY COVER threshold is met and there is additional LIVE PLUS MISSING CANOPY COVER on the acre plot, crews can estimate the remaining LIVE PLUS MISSING CANOPY COVER using the ocular method.

3. If the 10% LIVE PLUS MISSING CANOPY COVER threshold is not met, a sample of all live seedlings, saplings, and trees that are within the acre plot (117.75 foot) radius is required. If the one-acre plot tree count reaches the sum of 200 stems of any combination of trees, seedlings and saplings, the condition will be sampled as accessible forestland.

4. As with the subplot method, the sample acre (117.75 foot radius plot) must fall entirely in the questionable condition.

Percent Canopy Cover Calculation for Acre method:

If a condition is close to 10% canopy cover, and other methods may not accurately represent tree canopy cover due to irregular spatial distribution of tree canopies (e.g., *clumpiness*), the Acre method provides another estimate of the total tree canopy area within the radius of a 1-acre plot located within the condition in question.

Given:
1. The area of an acre is 43,560 ft^{2}.
2. A 1-acre circle has a radius of 117.75 ft.
3. 10% of 1-acre is 4,356 ft^2.

and assuming the canopies to be ellipses:

1. Measure the approximate canopy diameter (long axis and short axis) for each tree on the acre.
2. Calculate the canopy area for each tree as Canopy Area = pi*long axis d/2*short axis d/2).
3. Add up the Canopy Areas, and divide by 435.6 (1% of an acre) to obtain percent cover (truncate)

Transition zones and forest/nonforest encroachment – When an accessible forest land condition encroaches into a nonforest condition, the border between forest and nonforest is often a gradual change in tree cover or stocking with no clear and abrupt boundary. This may cause difficulties determining exactly where the forested area meets the minimum canopy cover or stem count criteria. For these cases, determine where the land clearly meets the minimum requirements, and where it clearly is less than required. Divide the zone between these points in half, and determine the side of the zone on which the subplot center is located. Classify the condition class of the subplot based on this line.

If the Acre plot falls on or very near a transition, the Acre plot should be moved into the condition identified at plot center (fig. 16).

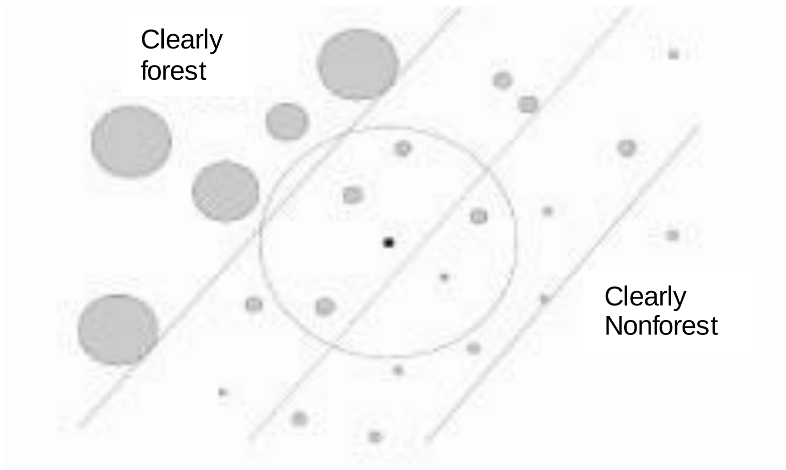


Figure 16. Example of classifying the condition class of the subplot in a transition zone with forest/Nonforest encroachment.

For example, at measurement time 1, a clear and distinct boundary existed between the forest and nonforest condition classes. At time 2, however, there now exists a zone of regeneration or small diameter trees between the previous forest condition and where the nonforest clearly remains. If the zone of encroachment meets cover / stem count criteria where it meets the nonforest, classify the entire zone as forest. If the zone is clearly nonforest up to the original stand, call it all nonforest. If the encroachment or transition zone does not clearly meet cover / stem count criteria where it meets the nonforest, determine where the land clearly meets the minimum requirements, and where it clearly is less than required. Divide the zone between these points in half,, and classify the entire subplot based on which side of the line the subplot center falls.

Sub-acre method - The Sub-Acre method is *only* used when the ocular method is not appropriate and *only* when the acre or subplot methods can not be established due to the condition's shape, dimensions or accessibility.

1. Ensure that the canopy cover sample area is representative of the condition in question.

2. Determine if minimum 10% LIVE PLUS MISSING CANOPY COVER is reached. The crew samples all live, dead, and missing tree canopies on the canopy cover sample plot as described above in LIVE PLUS MISSING CANOPY COVER. The 10% threshold is dependent on the sample plot size and respective area in square feet.

3. If the 10% LIVE PLUS MISSING CANOPY COVER threshold is met and there is additional LIVE PLUS MISSING CANOPY COVER on the sub-acre plot, crews can estimate the remaining LIVE PLUS MISSING CANOPY COVER using the ocular method.

4. If the 10% LIVE PLUS MISSING CANOPY COVER threshold is not met, the estimate of all live seedlings, saplings, and trees (stem count x appropriate stem count multiplier) must be 200 or greater for the condition to qualify as accessible forestland.

5. As with the acre and subplot method, the sub-acre sample plot(s) must fall entirely in the questionable condition.

6. Potential circular plot sizes and appropriate scaling factors:

Acre Fraction	Radius (ft)	Area (sq ft)	10% Cover (sq ft)	Stem Count Multiplied
1	117.7	43,560	4356	x1
1/2	83.3	21,780	2178	x2
1/3	67.6	14,520	1452	x3
1/4	58.9	10,890	1089	x4
1/5	52.7	8,712	872	x5
1/6	49.0	7,260	726	x6

When collected: CONDITION CLASS STATUS = 1 or 2
Field width: 1 digit
Tolerance: None
MQO: At least 90% of the time
Values:

1	Ocular method
2	Subplot method
3	Acre method
4	Sub-acre method

5.7.27 LIVE CANOPY COVER (CORE 2.5.26) [LIVE_CANOPY_CVR_PCT]

Record the percentage of LIVE CANOPY COVER for the condition. Include live tally trees, saplings, and seedlings that cover the sample area. For conditions where the LIVE CANOPY COVER is low and there is a question whether it meets 10 percent LIVE CANOPY COVER, the crew will measure every crown width within the canopy cover sample area. When the 10% threshold is determined by measuring crown widths, the crew can use the ocular method to determine the total LIVE CANOPY COVER value.

Canopy widths are measured using the ellipse formula for calculation of canopy area. This requires two measurements. The first measurement is the long axis diameter. The second measurement is made at

90 degrees to the first measurement at the widest point of the crown (fig. 17). Canopy area = pi*((long axis diameter/2)*(90 degrees axis diameter/2)).

- Do not include the crown portion of trees, saplings, or seedlings that are vertically overtopped by other trees, saplings or seedlings.
- Only include tree canopy measurements from trees with stems that originate within the sample area, although canopy measurements can extend outside the sample area.
- Occasionally, a branch may protrude abnormally, but the lateral crown line is drawn across the portion of the branch which includes the "normal outline" of the tree.
- For leaning trees, ocularly upright the trees and measure crowns as if the trees were upright.

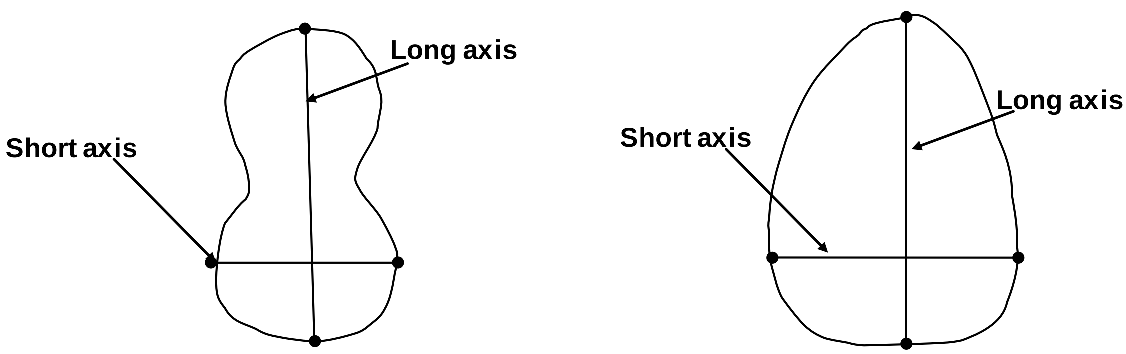


Figure 17. Examples of where to measure canopy widths.

LIVE CANOPY COVER can be based on an ocular estimate when the condition in question is certain to contain greater than 10% LIVE PLUS MISSING CANOPY COVER or TOTAL STEMS greater than 200.

When collected: All CONDITION CLASS STATUS = 1 or 2
Field width: 2 digits
Tolerance: 0 – 12% - No errors
13 – 20% - 10% error
21 – 100% - 25% error
MQO: At least 99% of the time
Values: 00 – 99 (where 99=99 to 100%)

5.7.28 LIVE PLUS MISSING CANOPY COVER (CORE 2.5.27) [LIVE_MISSING_CANOPY_CVR_PCT]

Record the percentage of LIVE PLUS MISSING CANOPY COVER for the condition by adding the LIVE CANOPY COVER plus the estimated missing canopy cover that existed prior to disturbance (harvesting, fire, chaining, etc). Include live and dead and removed tally trees, saplings, and seedlings. Base the estimate on field observations, aerial photos, historical aerial imagery, and similar evidence of undisturbed conditions. The total of the LIVE PLUS MISSING CANOPY COVER cannot exceed 100%.

When collected: CONDITION CLASS STATUS = 1 or 2
Field width: 2 digits
Tolerance: 0 – 12% - No errors
13 – 20% - 10% error
21 – 100% - 25% error
MQO: At least 80% of the time
Values: 00 – 99 (where 99=99 to 100%)

5.7.29 TOTAL STEMS (CORE 2.5.28) [NBR_LIVE_STEMS]]

Record the estimated number of live stems per acre of the condition. Base the estimate on actual stem count of tally tree species within the sample area. When using the subplot method, use the appropriate expansion factor according to tree and plot size to obtain an estimate of the number of live stems per acre. Using microplots (i.e., the subplot method) to estimate stems <5.0 inches diameter in conditions with wide spacing or 'clumping' is discouraged.

When collected: CONDITION CLASS STATUS = 1 OR 2 AND CANOPY COVER SAMPLE METHOD > 1
Field width: 5 digits
Tolerance: 10%
MQO: At least 90% of the time
Values: 00000 - 99999

5.8 CONDITION NONSAMPLED REASON (CORE 2.4.3) [COND_NONSAMPLE_REASN_CD]

For portions of plots that cannot be sampled (CONDITION CLASS STATUS = 5), record one of the following reasons.

When collected: When CONDITION CLASS STATUS = 5
Field width: 2 digits
Tolerance: No errors
MQO: At least 99% of the time
Values:

01	Outside U.S. boundary – Assign this code to condition classes beyond the U.S. border.
02	Denied access area – Any area within the sampled area of a plot to which access is denied by the legal owner, or to which an owner of the only reasonable route to the plot denies access. There are no minimum area or width requirements for a condition class delineated by denied access. Because a denied-access condition can become accessible in the future, it remains in the sample and is re-examined at the next occasion to determine if access is available.
03	Hazardous situation – Any area within the sampled area on plot that cannot be accessed because of a hazard or danger, for example cliffs, quarries, strip mines, illegal substance plantations, temporary high

water, etc. Although the hazard is not likely to change over time, a hazardous condition remains in the sample and is re-examined at the next occasion to determine if the hazard is still present. There are no minimum size or width requirements for a condition class delineated by a hazardous condition.

10	Other – This code is used whenever a condition class is not sampled due to a reason other than one of the specific reasons listed. A field note is required to describe the situation.

5.9 CONDITION CLASS NOTES (PNW) [NOTES]

Record any notes needed to clarify or explain a special situation in the particular condition class being defined.

When collected: All plots, use when clarification is needed
Field width: 2000 characters
Tolerance: N/A
MQO: N/A
Values: Single words and abbreviated sentences

6 SUBPLOT/SEEDLING DATA

Each subplot is described by a series of area parameters relating to topographic features and existing cover type. These data also relate to the microplot, since the microplot is contained within the subplot perimeter.

6.1 SUBPLOT NUMBER (CORE 3.1) [SUBP]

Record the code corresponding to the number of the subplot.

When Collected: All subplots
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values:
1 Center subplot
2 North subplot
3 Southeast subplot
4 Southwest subplot

6.2 SUBPLOT STATUS (CORE 3.2) [STATUSCD]

Indicate whether or not this subplot currently has at least one accessible forest land condition class. In situations where a subplot is denied access or hazardous, but obviously contains no forest land, record SUBPLOT STATUS = 2. In cases where a subplot is access-denied or hazardous land use and has the possibility of forest, record SUBPLOT STATUS = 3.

When collected: All subplots
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values:
1 Sampled – at least one accessible forest land condition present on subplot
2 Sampled – no accessible forest land condition present on subplot
3 Nonsampled – possibility of forest land
4 Sampled – QA crew only measured condition, boundary and some subplot level data. For use only on check plots (QA STATUS = 2 - 6). Not a legal entry on production plots (QA STATUS = 1 or 7).

6.3 SUBPLOT NONSAMPLED REASON (CORE 3.3) [POINT_NONSAMPLE_REASN_CD]

For entire subplots that cannot be sampled, record one of the following reasons.

When collected: When SUBPLOT STATUS = 3
Field width: 2 digits
Tolerance: No errors
MQO: At least 99% of the time
Values:
01 Outside U.S. boundary – Assign this code to condition classes beyond the U.S. border.

02 Denied access area – Any area within the sampled area of a plot to which access is denied by the legal owner, or to which an owner of the only reasonable route to the plot denies access. There are no minimum area or width requirements for a condition class delineated by denied access. Because a denied-access condition can become accessible in the future, it remains in the sample and is re-examined at the next occasion to determine if access is available.

03 Hazardous situation – Any area within the sampled area on plot that cannot be accessed because of a hazard or danger, for example cliffs, quarries, strip mines, illegal substance plantations, temporary high water, etc. Although the hazard is not likely to change over time, a hazardous condition remains in the sample and is re-examined at the next occasion to determine if the hazard is still present. There are no minimum size or width requirements for a condition class delineated by a hazardous condition

04 Time limitation – This code applies to full subplots that cannot be sampled due to a time restriction. This code is reserved for areas with limited access, and in situations where it is imperative for the crew to leave before the plot can be completed (e.g., scheduled helicopter rendezvous). Use of this code requires notification to the field supervisor. This code should not be used for an entire plot (use code 8 [skipped visit] when an entire plot is skipped; see Section 4.18).

05 Lost data – The plot data file was discovered to be corrupt after a panel was completed and submitted for processing. This code is assigned to entire plots or full subplots that could not be processed, and is applied at the time of processing after notification to the region. Note: This code is for office use only.

10 Other – This code is used whenever a plot or condition class is not sampled due to a reason other than one of the specific reasons already listed. A SUBPLOT NOTE is required to describe the situation.

6.4 NONFOREST SUBPLOT STATUS (CORE 3.4) [NF_SUBP_STATUS_CD]

Record the code that describes the sampling status of the other-than-forest subplot, i.e., SUBPLOT STATUS = 2. In cases where subplot is denied access or hazardous, but obviously contains no nonforest land, i.e., subplot is either noncensus water or census water, record NONFOREST SUBPLOT STATUS = 2.

When collected: When NONFOREST SAMPLING STATUS = 1 and SUBPLOT STATUS = 2
Field width: 1 digit
Tolerance: no errors
MQO: At least 99% of the time
Values:

1 Sampled – at least one accessible nonforest land condition present on the subplot.
2 Sampled – no nonforest land condition present on subplot, i.e., subplot is either census and/or noncensus water.
3 Nonsampled nonforest

6.5 NONFOREST SUBPLOT NONSAMPLED REASON (CORE 3.5) [NF_SUBP_NONSAMPLE_REASN_CD]

For entire nonforest subplots that can not be sampled, record one of the following reasons.

When collected: When NONFOREST SAMPLING STATUS = 1 and SUBPLOT STATUS = 2 and NONFOREST SUBPLOT STATUS = 3
Field width: 2 digits
Tolerance: no errors
MQO: At least 99% of the time
Values:

02 Denied access – A subplot to which access is denied by the legal owner, or to which an owner of the only reasonable route to the plot denies access. Because a denied-access subplot can become accessible in the future, it remains in the sample and is re-examined at the next occasion to determine if access is available.

03 Hazardous situation – A subplot that cannot be accessed because of a hazard or danger, for example cliffs, quarries, strip mines, illegal substance plantations, temporary high water, etc. Although the hazard is not likely to change over time, a hazardous condition remains in the sample and is re-examined at the next occasion to determine if the hazard is still present.

04 Time limitation – This code applies to a full subplot that cannot be sampled due to a time restriction. This code is reserved for areas with limited access, and in situations where it is imperative for the crew to leave before the plot can be completed (e.g., scheduled helicopter rendezvous). Use of this code requires notification to the field supervisor.

10 Other – This code is used whenever a subplot is not sampled due to a reason other than one of the specific reasons already listed. A SUBLOT NOTE is required to describe the situation.

6.6 PREVIOUS SUBPLOT CENTER CONDITION (PNW) [PREV_SUBPCOND_PNWRS]

Downloaded code indicating the CONDITION CLASS NUMBER of the condition class at the subplot center recorded at the previous visit.

When collected: When SAMPLE KIND = 2: All subplots
Field width: 1 digit
Tolerance: No errors
MQO: N/A
Values: 1 to 9

6.7 SUBPLOT CENTER CONDITION (CORE 3.6) [SUBPCOND]

Record the CONDITION CLASS NUMBER of the condition class at the subplot center.

When collected: All subplots
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values: 1 to 9

6.8 SUBPLOT CENTER CONDITION CLASS STATUS CHANGE (PNW) [SUBCOND_CHG_PNWRS]

This data item is used to describe why a change occurs in the CONDITION CLASS STATUS of the subplot center between inventories. It distinguishes physical change from differences attributed to procedural change when CONDITION STATUS changes from forest land to nonforest land, Census or noncensus water, and vice versa. Record the code which describes the cause of the change.

When collected: When SAMPLE KIND = 2: PREVIOUS CONDITION CLASS STATUS at subplot center = 1 and the current CONDITION CLASS STATUS at subplot center = 2, 3 or 4; or When SAMPLE KIND = 2: PREVIOUS CONDITION CLASS STATUS at subplot center = 2, 3, or 4 and current CONDITION CLASS STATUS at subplot center = 1

Field width: 1 digit
Tolerance: No errors
Values:

1 SUBPLOT CENTER CONDITION has been changed to reflect a physical change in the condition, resulting in a difference from the subplot condition previously recorded.

2 SUBPLOT CENTER CONDITION has been changed to correct an error from previous crew.

3 SUBPLOT CENTER CONDITION has been changed to reflect a change in data item definition.

6.9 SUBPLOT CONDITION LIST (CORE 3.11) [CONDLIST]

This is a listing of all condition classes located within the 24.0-foot radius around the subplot center. A maximum of four conditions is permitted at any individual subplot. If a condition class has already been defined at a previously completed subplot, use the same condition class number whenever that condition is encountered. Define new condition classes as they are encountered. If more than one condition class is listed here, boundary data are required. If only one condition class is listed, this condition is automatically assigned to the subplot center and microplot center. If less than four condition classes occur on this subplot, complete the remainder of this field with zeros. For example, if condition 1 is the only condition class on a subplot, record 1000.

When collected: All plots
Field width: 4 digits
Tolerance: No errors
MQO: At least 99% of the time
Values: 1000 to 9876

6.10 MICROPLOT CENTER CONDITION (CORE 3.7) [MICROCOND]

Record the CONDITION CLASS NUMBER of the condition class at the microplot center.

When collected: All microplots
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values: 1 to 9

6.11 SUBPLOT SLOPE (CORE 3.8) [SLOPE]

Record the angle of slope across the subplot to the nearest 1 percent. SUBPLOT SLOPE is determined by sighting the clinometer along a line parallel to the average incline (or decline) of each subplot. This angle is measured along the shortest pathway down slope before the drainage direction changes. To measure SUBPLOT SLOPE, Observer 1 should stand at the uphill edge of the subplot and sight Observer 2, who stands at the downhill edge of the subplot. Sight Observer 2 at the same height as the eye-level of Observer 1. Read the slope directly from the percent scale of the clinometer:

- If slope changes gradually across the subplot, record an average slope.
- If slope changes across the subplot but the slope is predominantly of one direction, code the predominant slope percentage rather than the average.
- If the subplot falls directly on or straddles a canyon bottom or narrow ridge top, code the average slope of the side hill(s).
- If the subplot falls on a canyon bottom or on a narrow ridge top, but most of the area lies on one side hill, code the slope of the side hill where most of the area lies.

When collected: All subplots with at least one accessible forest land condition present on subplot (SUBPLOT STATUS = 1) or subplots with an accessible nonforest condition class present when nonforest is being sampled (NONFOREST SAMPLING STATUS = 1 and SUBPLOT STATUS = 2 and NONFOREST SUBPLOT STATUS = 1)

Field width: 3 digits
Tolerance: +/- 10%
MQO: At least 90% of the time
Values: 000 to 155

6.12 SUBPLOT ASPECT (CORE 3.9) [ASPECT]

Record the aspect across the subplot, to the nearest 1 degree. SUBPLOT ASPECT is determined along the direction of slope for land surfaces with at least 5 percent slope in a generally uniform direction. SUBPLOT ASPECT is measured with a hand compass along the same direction used to determine slope.

- If aspect changes gradually across the subplot, record an average aspect.
- If aspect changes across the subplot but the aspect is predominately of one direction, code the predominate direction rather than the average.
- If the subplot falls on or straddles a canyon bottom or narrow ridge top, code the aspect of the ridge line or canyon bottom.
- If the subplot falls on a canyon bottom or on a narrow ridge top, but most of the area lies on one side hill, code the aspect of the side hill.

When collected: All subplots with at least one accessible forest land condition present on subplot (SUBPLOT STATUS = 1) or subplots with an accessible nonforest condition class present when nonforest is being sampled (NONFOREST SAMPLING STATUS = 1 and SUBPLOT STATUS = 2 and NONFOREST SUBPLOT STATUS = 1)

Field width: 3 digits
Tolerance: +/- 10 degrees
MQO: At least 90% of the time

Values:
000 no aspect, slope < 5 percent
001 1 degree
002 2 degrees
… …
... …
360 360 degrees, due north

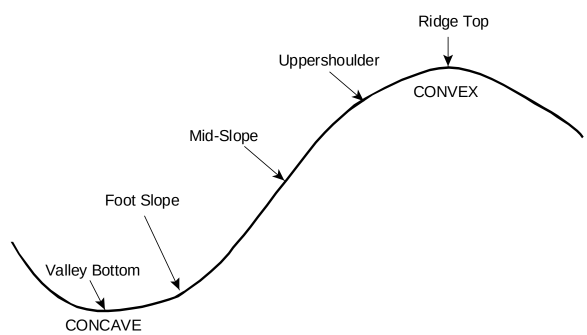
6.13 SLOPE SHAPE (HAWAII) [SLOPE_SHAPE_PNWRS]

Record the slope shape over the subplot under consideration:

When collected: All subplots with at least one accessible forest land condition present on subplot (SUBPLOT STATUS = 1) or subplots with an accessible nonforest condition class present when nonforest is being sampled (NONFOREST SAMPLING STATUS = 1 and SUBPLOT STATUS = 2 and NONFOREST SUBPLOT STATUS = 1)

Field width: 2 digits
Tolerance: No errors
MQO: At least 90% of the time
Values:

Flat = 00
Concave = 10
Convex = 20



6.14 SLOPE POSITION (HAWAII) [SLOPE_POSITION_PNWRS]

Record the slope position over the subplot under consideration.

When collected: All subplots with at least one accessible forest land condition present on subplot (SUBPLOT STATUS = 1) or subplots with an accessible nonforest condition class present when nonforest is being sampled (NONFOREST SAMPLING STATUS = 1 and SUBPLOT STATUS = 2 and NONFOREST SUBPLOT STATUS = 1)

Field width: 2 digits
Tolerance: +/- 1 class for codes 10-30
Other codes – no errors
MQO: At least 90% of the time

Values:

No Slope	=	00
Uppershoulder	=	10
Midslope	=	20
Footslope	=	30
Valleybottom	=	40
Ridgetop	=	50

To more accurately measure the moisture-related effects of topography on vegetation, two separate, calculated indices will be computed in the lab from data gathered in the field: 1.) an index of moisture demand and 2.) an index of moisture supply. For moisture demand, the aspect, slope and elevation at each plot is used to approximate annual moisture demand from “Potential Solar Beam Irradiation on Slopes” tables or equations (Frank and Lee 1966). Moisture supply is estimated from an additive, modified, topographic relative moisture index (TRMI; Parker 1982) constructed using slope shape, percent slope and slope position. Higher moisture supply values occur on footslopes, gentle slopes and/or sites exhibiting slope concavities.

6.15 SNOW/WATER DEPTH (CORE 3.10) [WATERDEP]

Record to the nearest 0.1 ft the average approximate depth of water or snow covering the subplot at the time of data collection. This variable is used to indicate subplots where some variables (e.g., seedling count, total heights) may be measured with less certainty due to conditions at the time of measurement.

This item is intended for water/snow/ice which covers substantial portions of subplots. Record “00” for streams contained within their banks and not affecting any measurements.

When collected: All subplots with at least one accessible forest land condition present on subplot (SUBPLOT STATUS = 1) or subplots with an accessible nonforest condition class present when nonforest is being sampled (NONFOREST SAMPLING STATUS = 1 and SUBPLOT STATUS = 2 and NONFOREST SUBPLOT STATUS = 1)

Field width: 2 digits (x.y)
Tolerance: +/- 0.5 ft
MQO: At the time of measurement (no MQO after initial date of visit)
Values: 0.0 to 9.9

6.16 PIG DAMAGE

Wild pigs have been introduced to the Hawaiian Islands by humans centuries ago. They were farmed loosely and become wild on the islands. These animals have no non-human predators and have subsequently expanded their populations. These populations have caused a lot of destruction to forests and other vegetated habitats. The following are examples of wild pig damage that may be encountered: rooting (sometimes called grubbing) where pigs dig up the soil and vegetation, compacted trails, wallows in wet soils, and rubbing on trees and shrubs.

Because of this problem crews will be assessing pig damage for each sampled condition on all subplots. Crews will record the percentage of the entire subplot (as viewed from above) that has noticeable pig damage to the ground and ground vegetation for each sampled condition. **It is important that this value is always estimated as a percent of an entire subplot.** Code the following data items as described.

6.16.1 SUBPLOT NUMBER OF PIG DAMAGE (HAWAII) [SUBP]

Record the code corresponding to the number of the subplot

When Collected: All subplots with at least one accessible forest land condition present on subplot (SUBPLOT STATUS = 1) or subplots with an accessible nonforest condition class present when nonforest is being sampled (NONFOREST SAMPLING STATUS = 1 and SUBPLOT STATUS = 2 and NONFOREST SUBPLOT STATUS = 1)

Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values:

1	Center subplot
2	North subplot
3	Southeast subplot
4	Southwest subplot

6.16.2 CONDITION CLASS NUMBER OF PIG DAMAGE (HAWAII) [CONDID]

When Collected: All subplots with at least one accessible forest land condition present on subplot (SUBPLOT STATUS = 1) or subplots with an accessible nonforest condition class present when nonforest is being sampled (NONFOREST SAMPLING STATUS = 1 and SUBPLOT STATUS = 2 and NONFOREST SUBPLOT STATUS = 1)

Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values: 1 to 9

6.16.3 PERCENT OF PIG DAMAGE ON SUBPLOT (HAWAII) [PIG_DAMAGE_PCT]

Record the estimated percentage of area of the subplot covered by pig damage for each sampled condition class found on subplot

When Collected: All subplots with at least one accessible forest land condition present on subplot (SUBPLOT STATUS = 1) or subplots with an accessible nonforest condition class present when nonforest is being sampled (NONFOREST SAMPLING STATUS = 1 and SUBPLOT STATUS = 2 and NONFOREST SUBPLOT STATUS = 1)

Field width: 3 digits
Tolerance: +/- 10 percent
MQO: At least 99% of the time
Values: 000 to 100

6.17 P2 VEG SUBPLOT SAMPLE STATUS (CORE OPTIONAL 8.4.2) [P2VEG_SUBP_STATUS_CD]

Record the code to indicate if the subplot was sampled for P2 vegetation. A condition may be sampled but not have any vascular plants present. If **all** the vegetation measurements cannot be completed on the subplot (for example, deep snow or water, hazardous weather, time limitation), enter code 2 and do not record **any** vegetation measurements.

When collected: On all subplots where P2 vegetation is being sampled on accessible forest land (P2 VEGETATION SAMPLING STATUS=1 and SUBPLOT STATUS = 1) or is being sampled on accessible forest land or nonforest land and at least one accessible nonforest land condition is present on the plot (P2 VEGETATION SAMPLING STATUS=2 and NONFOREST SUBPLOT STATUS=1)

Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values:

1	Subplot sampled
2	Subplot not sampled

6.18 VEGETATION NONSAMPLED REASON (CORE OPTIONAL 8.4.3) [P2VEG_SUBP_NONSAMPLE_REASN_CD]

Record the reason why vegetation on a subplot cannot be sampled.

When collected: On all subplots where P2 vegetation is being sampled on all accessible land conditions (P2 VEG SUBPLOT SAMPLE STATUS = 2)

Field width: 2 digits
Tolerance: No errors
MQO: At least 99% of the time
Values:

04	Time limitation
05	Lost data (for office use only)
10	Other (for example, snow or water covering vegetation that is supposed to be sampled)

6.19 INVASIVE PLANT SUBPLOT STATUS (CORE OPTIONAL 9.5) [INVASIVE_SUBP_STATUS_CD]

(Subplot level data item) Record the code to indicate whether the subplot was sampled for invasive plants. A subplot may be sampled but not have any invasive plants present. If there is **any** part of an accessible portion of the subplot where other plot measurements are made but invasive plants can't be assessed (e.g., because of snow, water, hazardous weather, time limitation), enter code 3 and do not record **any** invasive plant measurements.

When collected: On all subplots where (INVASIVE PLANT SAMPLING STATUS=1 and SUBPLOT STATUS=1) or (INVASIVE PLANT SAMPLING STATUS=2 and NONFOREST SUBPLOT STATUS=2)

Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values:

1	Subplot sampled, invasive plants present
2	Subplot sampled, no invasive plants present
3	Subplot not sampled for invasive plants

6.20 INVASIVE PLANT NONSAMPLED REASON (CORE OPTIONAL 9.6) [INVASIVE_NONSAMPLE_REASN_CD]

(Subplot level data item) Record the reason why a subplot cannot be sampled for invasive plants.

When collected: On all subplots where INVASIVE PLANT SUBPLOT STATUS = 3
Field width: 2 digits
Tolerance: No errors
MQO: At least 99% of the time
Values:

4 Time limitation
5 Lost data (office use only)

10 Other (for example, snow or water covering vegetation that is supposed to be sampled) (Requires INVASIVE PLANT DATA NOTES)

6.21 HIGH TALLY SAPLING PROCEDURES (HAWAII) [HIGH_TALLY_SAPLING_CD_PNWRS]

Record whether or not high tally sapling protocol will be used for the microplot associated with the selected subplot. See "Microplots with excessive saplings" on page 134 for specifics on the use of this protocol.

When Collected: All subplots with at least one accessible forest land condition present on subplot (SUBPLOT STATUS = 1) or subplots with an accessible nonforest condition class present when nonforest is being sampled (NONFOREST SAMPLING STATUS = 1 and SUBPLOT STATUS = 2 and NONFOREST SUBPLOT STATUS = 1)

Field width: 1 digit
Tolerance: No errors
Values:
0 high tally sapling procedures **are not** used on the microplot (normal tally procedures followed)
1 high tally sapling procedures **are** used on the microplot

6.22 SUBPLOT NOTES (PNW) [NOTES]

Record any notes needed to clarify or explain a special situation encountered on the subplot.

When collected: All plots, as needed
Field width: 2000 characters
Tolerance: N/A
MQO: N/A
Values: Single words and abbreviated sentences

6.23 SEEDLING DATA

Stocking and regeneration information are obtained by counting live seedlings within the 6.8-foot radius microplot located 90 degrees and 12.0 feet from each subplot center within each of the four subplots. Conifer seedlings must be at least 6.0 inches in length and less than 1.0 inch at DBH in order to qualify for tallying. Hardwood seedlings must be at least 12.0 inches in length and less than 1.0 inch at DBH in order to qualify for tallying. Seedlings are counted in groups by species and condition class, up to five individuals per species. Counts beyond five estimated. Only count seedlings occurring in accessible forest land condition classes (CONDITION CLASS STATUS = 1) and accessible nonforest condition classes when nonforest is being sampled (NONFOREST SAMPLING STATUS = 1 and CONDITION CLASS STATUS = 2 and NONFOREST CONDITION CLASS STATUS = 2).

Count all live seedlings that have their base inside the microplot boundary regardless of vigor, damage, or closeness to other trees, but count only one seedling from a clump; a clump is 3 or more live stems that sprouted from a common root base (including stumps).

6.24 SEEDLING COUNT DATA ITEMS

Seedlings are counted within each accessible forestland (condition status 1) condition class on each microplot. Record the following data items for each seedling count:

6.24.1 SUBPLOT NUMBER (CORE 6.1) [SUBP]

This is a generated code corresponding to the number of the subplot

When Collected: All seedling count records
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values:

1	Center subplot
2	North subplot
3	Southeast subplot
4	Southwest subplot

6.24.2 CONDITION CLASS NUMBER (CORE 6.3) [CONDID]

Use the same procedures defined in the Condition Class Chapter to assign the appropriate CONDITION CLASS NUMBER to the seedlings rooted in the respective condition.

When Collected: All seedling count records
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values: 1-9

6.24.3 SPECIES (CORE 6.2) [SPCD]

Record the SPECIES code from the Tree Species List. Use the same procedures as the data item found in the Tree and Sapling Data Chapter

When Collected: All seedling count records
Field width: 4 digits
Tolerance: No errors for genus, no errors for species
MQO: At least 90% of the time for genus, at least 85% of the time for species
Values: See Appendix 1 (Tree Species List, page 199)

6.24.4 SEEDLING COUNT (CORE 6.4) [TREECOUNT]

On each microplot, record the number of live tally tree seedlings, by species and condition class. Count up to five individuals by species: estimate the total count if there are more than five individuals of any given species in any given condition class. When seedlings are distributed evenly on a microplot, a suggested method of estimating is to count the number of seedlings on one quarter of the microplot and multiply by four (given that there is only one condition class on the microplot). Repeat for each species. Conifer seedlings must be at least 6.0 inches in length and less than 1.0 inch at DBH to qualify for counting. Hardwood seedlings must be at least 12.0 inches in length and less than 1.0 inch at DBH in order to qualify for counting.

Multiple “suckers” that originate from the same location, and stump sprouts are considered one seedling. Do not tally or count “layers” (undetached branches partially or completely covered by soil, usually at the base) as seedlings. Do not tally any seedlings that sprout from a live tally tree.

When Collected: Each accessible forest land condition class (CONDITION CLASS STATUS = 1) on each microplot and each accessible nonforest condition classes on each microplot when nonforest is being sampled (NONFOREST SAMPLING STATUS = 1 and CONDITION CLASS STATUS = 2 and NONFOREST CONDITION CLASS STATUS = 2)

Field width: 3 digits
Tolerance: No errors for 5 or fewer per species; +/- 20% over a count of 5
MQO: At least 90% of the time
Values: 001 through 999

6.24.5 SEEDLING NOTES (PNW) [NOTES]

Record notes to clarify or explain a special situation in the SEEDLING NOTES.

When collected: As needed
Field width: 2000 characters
Tolerance: N/A
MQO: N/A
Values: Single words and abbreviated sentences

7.0 BOUNDARY REFERENCES

Boundary reference data are used to compute the area for the condition classes sampled on a plot and to remeasure plots. Record all boundaries between condition classes that occur within the sampled (fixed-radius) area on subplots and microplots. Boundaries outside sampled (fixed-radius) areas are not referenced.

In addition to using the recording procedures described herein, sketch maps of condition class boundaries onto the pre-printed plot diagrams on paper field tally sheets.

7.1 REFERENCE PROCEDURE

Within the sampled area on each microplot, reference the approximate boundary of each condition class that differs from the condition classes at a subplot center. Trees selected on these fixed-radius plots are assigned to the actual condition in which they lie regardless of the recorded approximate boundary delineated.

Boundary referencing is done by recording azimuths and distances from subplot center to the reference points and/or from microplot center to the reference points (figs. 18 and 19). Each boundary is marked by a maximum of three points - two where the boundary intersects the subplot circumference or microplot circumference, and one "corner" point between the two end points, if necessary. Only the corner point requires a distance, since the distance from the center to the circumference is always equal to the fixed plot radius.

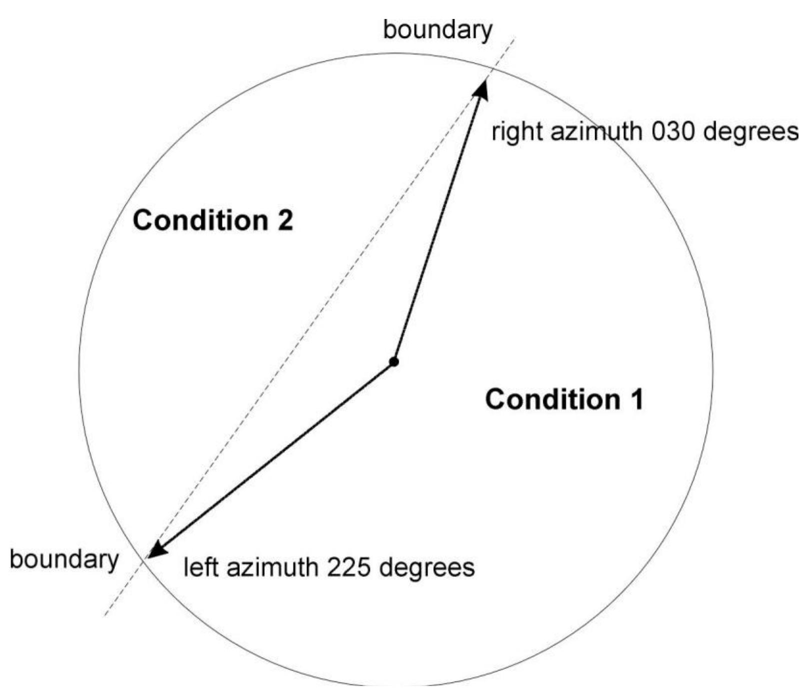


Figure 18. How to measure a straight boundary on a microplot or subplot.

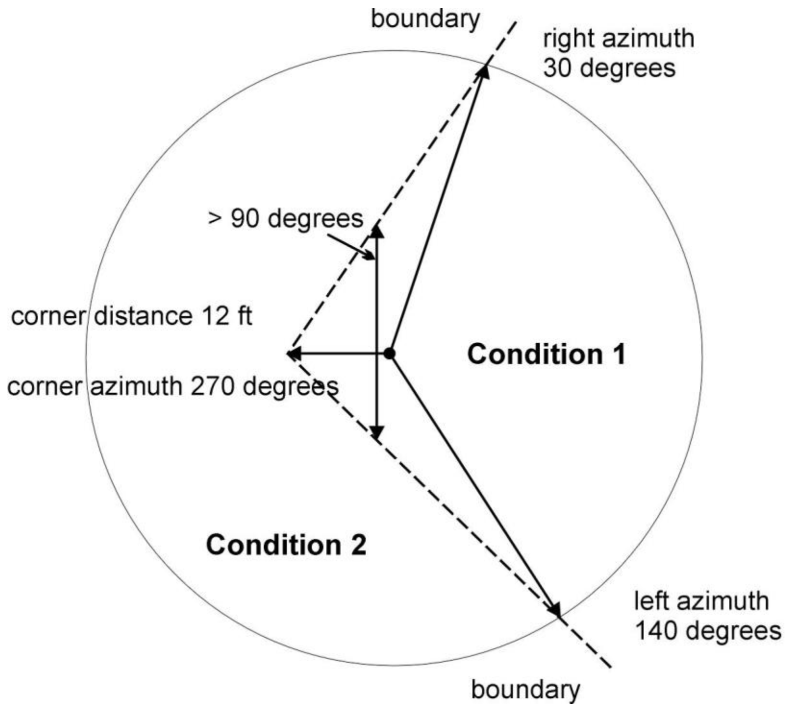


Figure 19. How to measure a boundary with a corner on a subplot.

Microplot boundaries are referenced to the microplot center. Note that the larger the plot, the greater likelihood of a need for a boundary corner to record boundaries that are not straight lines.

Refer condition class delineation guidelines starting on page 63. The following additional rules apply when referencing a boundary within a subplot or microplot:

1. When a boundary between accessible forest land and nonforest land or between two contrasting accessible forest land condition classes is clearly marked, use that feature to define the boundary. Examples of clear demarcation are a fence line, plowed field edge, sharp ridge line, and water's edge along a stream course, ditch, or canal.

2. When a boundary between forest land and nonforest land is not clearly marked by an obvious feature, the boundary should follow the nonforest side of the stems of the trees at the forest edge.

3. When a boundary between two contrasting forest land condition classes is not clearly marked, map along the stems of the contrasting condition. When the boundary between two contrasting forest land condition classes is separated by a narrow linear inclusion (creek, fire line, narrow meadow, unimproved road), establish the boundary at the far edge of the inclusion relative to subplot center, of the inclusion.

4. When a plot is remeasured, the crew will examine the boundaries referenced at last inventory. If no change has occurred, the current crew will retain the boundary data that were recorded at last inventory. If a boundary has changed, or a new boundary is present, or the previous crew made an obvious error, record new or updated boundary data. Delete boundaries that are no longer distinct.

5. Although individual MQOs are specified for the azimuths and distances, in practice a crew will be considered 'correct' when the difference in areas as mapped by the original crew and by the QA crew is less than 10% of the subplot or microplot area. This allows for slight variations in azimuths or distances due to the approximate nature of our mapping procedures.

7.2 BOUNDARY DATA

Record the appropriate values for each boundary mapped on the subplot or microplot as follows:

7.2.1 SUBPLOT NUMBER (CORE 3.1) [SUBP]

Generated code corresponding to the number of the subplot.

When Collected: All boundaries
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values:

1	Center subplot
2	North subplot
3	Southeast subplot
4	Southwest subplot

7.2.2 PLOT TYPE (CORE 4.2.2) [SUBPTYP]

Record the code to specify whether the boundary data are for a subplot or microplot.

When collected: All boundaries
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values:

null	No boundaries are recorded for the subplot
1	Subplot boundary
2	Microplot boundary

7.2.3 BOUNDARY CHANGE (CORE 4.2.3) [BNGCHG]

Remeasurement (SAMPLE KIND = 2) locations only. Record the appropriate code to indicate the relationship between previously recorded and current boundary information.

When collected: SAMPLE KIND = 2, All boundaries
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values:

0	No change - boundary is the same as indicated on plot map and/or data collected by a previous crew.

1	New boundary, or boundary data has been changed to reflect an actual on-the-ground physical change resulting in a difference from the boundaries recorded.
2	Boundary has been changed to correct an error from previous crew.
3	Boundary has been changed to reflect a change in variable definition.

7.2.4 CONTRASTING CONDITION (CORE4.2.4) [CONTRAST]

Record the CONDITION CLASS NUMBER of the condition class that contrasts with the condition class located at the subplot center (for boundaries on the subplot) or at the microplot center (for boundaries on the microplot), e.g., the condition class present on the other side of the boundary line.

When collected: All boundaries
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values: 1 to 9

7.2.5 LEFT AZIMUTH (CORE 4.2.5) [AZMLEFT]

Record the azimuth from the subplot or microplot center to the farthest left point (facing the contrasting condition) where the boundary intersects the subplot or microplot circumference.

When collected: All boundaries
Field width: 3 digits
Tolerance: +/- 10 degrees
MQO: At least 90% of the time
Values: 001 to 360

7.2.6 CORNER AZIMUTH (CORE 4.2.6) [AZMCORN]

Record the azimuth from the subplot or microplot center to a corner or curve in a boundary. If a boundary is best described by a straight line between the two circumference points, then record 000 for CORNER AZIMUTH (000=none).

When collected: All boundaries
Field width: 3 digits
Tolerance: +/- 10 degrees
MQO: At least 90% of the time
Values: 000 to 360

7.2.7 CORNER DISTANCE (CORE 4.2.7) [DISTCORN]

Record the horizontal distance, to the nearest 1 ft, from the subplot or microplot center to a boundary corner point.

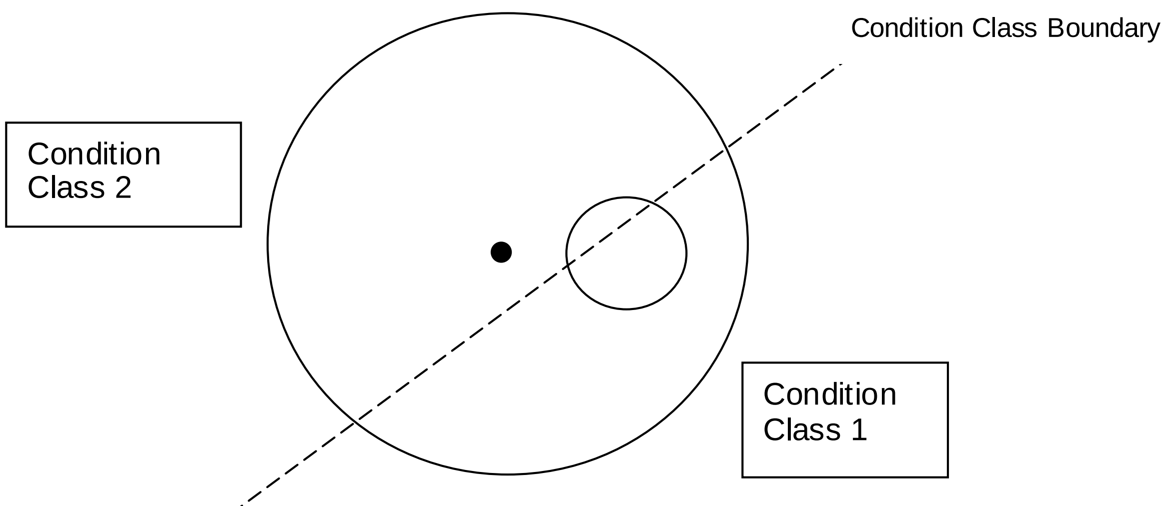
When collected: All boundaries when CORNER AZIMUTH > 000
Field width: 3 digits
Tolerance: +/- 1 ft
MQO: At least 90% of the time
Values:
Microplot: 001 to 007 feet, (actual limiting distance is 6.8 feet)
Subplot: 001 to 024 feet

7.2.8 RIGHT AZIMUTH (CORE 4.2.8) [AZMRIGHT]

Record the azimuth from subplot or microplot center to the farthest right point (facing the contrasting condition) where the boundary intersects the subplot or microplot circumference.

When collected: All boundaries
Field width: 3 digits
Tolerance: +/- 10 degrees
MQO: At least 90% of the time
Values: 001 to 360

Example of mapping on Subplot 3



Subplot	Plot type	Boundary Change	Contrasting Condition	left azimuth	corner azimuth	corner distance	right azimuth
3	1	0	1	65	0	0	220
3	2	0	2	250	0	0	25

7.2.9 BOUNDARY NOTES (PNW) [NOTES]

Record electronic BOUNDARY NOTES, if needed, to clarify or explain a special situation in the boundary being defined.

When collected: As needed
Field width: 2000 characters
Tolerance: N/A
MQO: N/A
Values: Single words and abbreviated sentences

8 VEGETATION PROFILE

The Phase 2 (P2) vegetation data are collected to provide vegetation structure and dominant species composition for vascular plants. The data collected provide a horizontal and vertical estimation of vegetation located within the sample area and provide information for the most abundant species found on the subplot. Information on the abundance, structure, and species composition of understory plant communities has many uses. It can be used to assess wildlife habitat, biomass, forage availability, grazing potential, vegetation competition with tree growth, fuel loadings from understory vegetation, and potential site productivity. The most abundant species provide information to classify plant community types into plant associations and to predict associated forest stand characteristics. Accurately representing the species present on a site and their change in abundance in response to forest development, disturbance, or management is therefore important to a wide variety of users. This information is also used to augment forest ecosystem health assessments from P3 plots, in terms of vegetation structure and rates of change of community vascular plant composition.

8.1 Vegetation Sampling Design

The Phase 2 Vegetation Profile includes measurements of vegetation structure – cover by layer and total aerial cover of each growth habit.

Sampling of vegetation is focused on accessible condition classes within the 24.0-foot radius subplot. Inventory units implementing the vegetation profile determine if they will include accessible forested lands, or any accessible land (P2 Vegetation Sampling Status). If the area of an accessible condition class is less than 100 percent on a subplot, vegetation measurements are done only on the portion that accessible. If multiple accessible condition classes are present on the subplot, separate estimates are made for each condition class area on the subplot.

Vegetation is best recorded when all plant species are fully leafed out. However, crews may end up visiting plots early in the season before leaves are fully expanded or late in the season when plants are beginning to senesce. Canopy cover is vertically projected from the outline of the foliage as they see it **at the time of plot visit.** Notes can be added to subplot records indicating unusual phenological conditions. Crews should not collect vegetation data in leaf off condition or when snow covers the plot (see 6.17 P2 VEG SUBPLOT SAMPLE STATUS).

8.2 General definitions

Canopy Cover – Canopy cover is defined as the area of ground surface covered by a vertical projection of the canopy of a vascular plant. The canopy is described by a polygon surrounding the outer edges of the foliage (fig. 20 Assessing Canopy Cover), without subtracting any normal spaces occurring between the leaves of plants (Daubenmire 1959[1]). Overlapping crowns within a species or growth habit are not double-counted; the maximum possible cover is 100 percent. All estimates on the cover of vegetation are focused on plants or plant parts that are located within the sampled condition class within the subplot perimeter (24.0-foot radius, horizontal distance) and any foliar parts overhanging the sampled condition class within the subplot. Canopy cover is collected by height layer or as a total

[1] Daubenmire. R. 1959. A canopy-coverage method of vegetational analysis. Northwest Science 33(1): 43-64.

<u>(aerial view) cover across all layers for all growth habits in *Vegetation Structure* (8.4). Total aerial cover is collected for recorded species in *Species Composition* (8.5). Cover is estimated to the nearest 1 percent. See tabulation below for cover to area relationships for a 1/24 acre subplot and figure 21 (example of growth habit by layer) for additional visual calibrations. Group practice in the field is a mandatory training exercise.</u>

Cover	Area (ft^2)	Square length on side (ft)	Circle radius (ft)
1%	18	4.3	2.4
3%	54	7.4	4.2
5%	90	9.5	5.4
10%	181	13.4	7.6
15%	271	16.5	9.3
20%	362	19.0	10.7
25%	452	21.3	12.0
50%	905	30.1	17.0

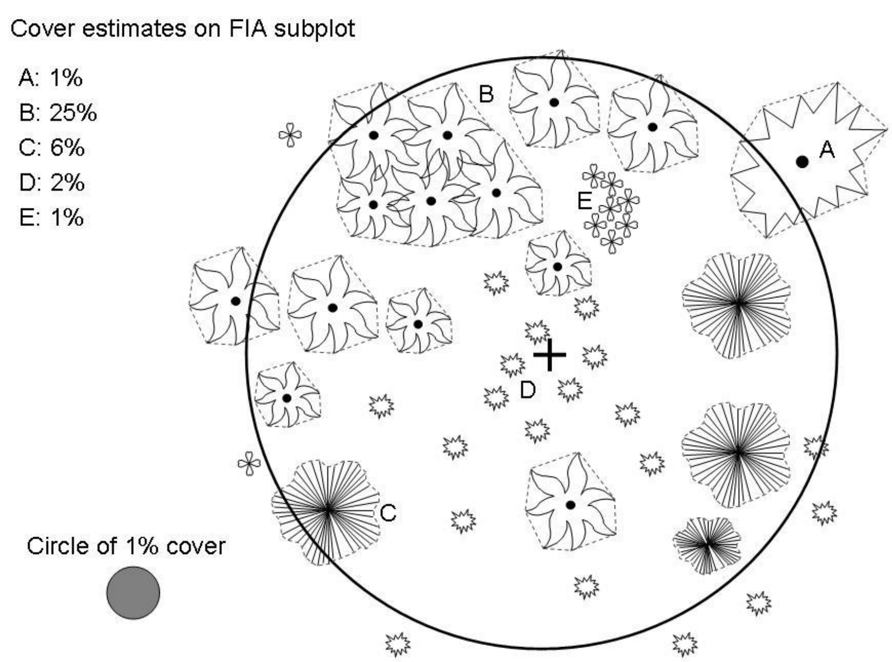


Figure 20. Assessing canopy cover. See individual variable text for more detail.

Growth Habits – P2 Vegetation data is collected by growth habits at each level of detail. In general, growth habits for vascular plants include trees, shrubs and woody vines, forbs, and grass-like plants (graminoids).

Layer Codes – Growth Habit groups are assessed by layers in *Vegetation Structure* (8.4), and one of the following layer codes (section 8.5.5 SPECIES VEGETATION LAYER) will be assigned to individual plant species in *Species Composition* (8.5).

NRCS PLANTS database – The Natural Resource Conservation Service (NRCS) PLANTS Database provides standardized information about the vascular plants, mosses, liverworts, hornworts, and lichens of the U.S. and its territories. It includes names, plant symbols, checklists, distributional data, species abstracts, characteristics, images, crop information, automated tools, onward Web links, and references:

USDA, NRCS. 2010. The PLANTS Database (http://plants.usda.gov, 1 January 2010). National Plant Data Center, Baton Rouge, LA 70874-4490 USA.
FIA currently uses a stable codeset downloaded in January of 2010.

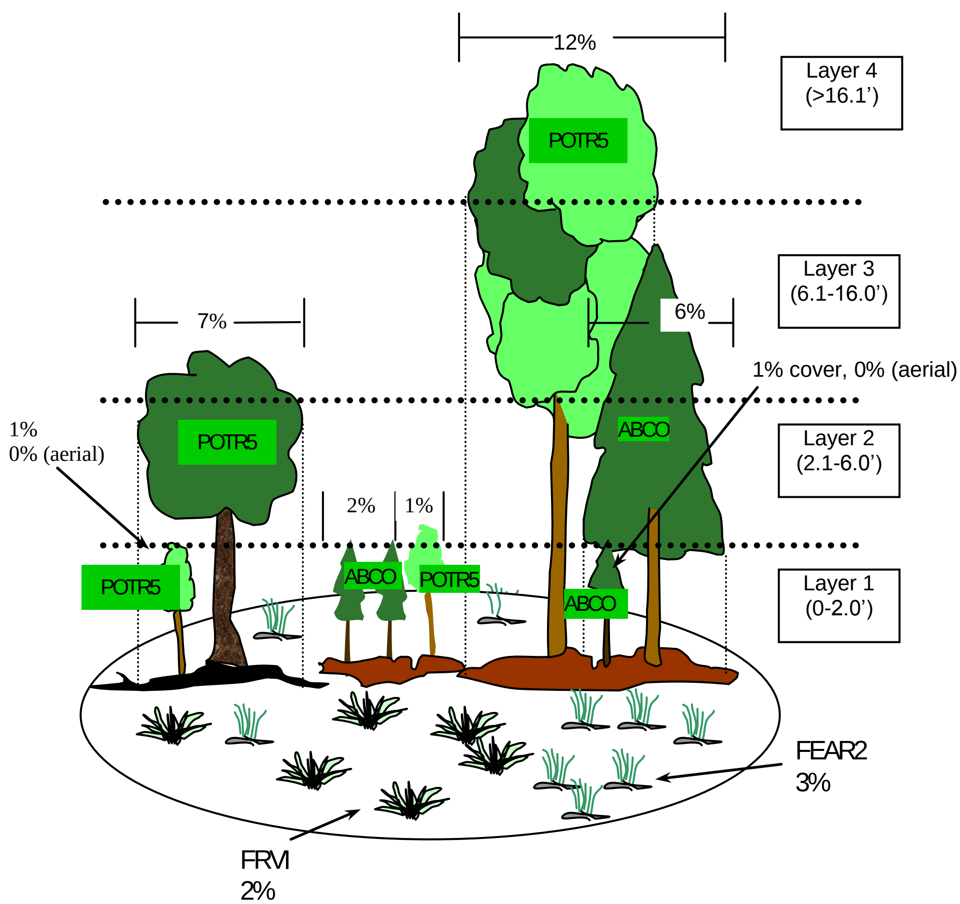


Figure 21. Example of growth habit by layer and species composition.

Table 1-Estimation of canopy cover by layer and aerial view of each growth habit in figure 21

Vegetation Structure **Growth Habit**	**Layer 1 (0-2.0')**	**Layer 2 (2.1'-6.0')**	**Layer 3 (6.1'-16.0')**	**Layer 4 (>16.1')**	**Aerial**
			Percent canopy cover		
Tally tree sp (TT)	005	013	019	08	022
Non-tally tree sp (NT)	000	000	000	000	000
Shrub & Vine (SH)	000	000	000	000	000
Forb (FB)	002	000	000	000	002
Graminoid (GR)	003	000	000	000	003

Table 2-Estimation of canopy cover by species in figure 21

Level of Detail	**Species Growth Habit**	**Species Code**	**Cover**	**Layer**
2	GR	FEAR2	003	1
2	SD	ABCO	003	1
2	SD	POTR5	008	3
3	LT	POTR5	008	4
3	LT	ABCO	006	3

Note: FRVI, estimated at 2%, was not recorded, and ABCO and POTR5 are present as two different growth habits (seedling/sapling and large tree) with at least 3% cover.

8.3 Vegetation Data Collection Location – Subplot-Level Variables

8.3.1 SUBPLOT NUMBER (CORE OPTIONAL 8.4.1) [SUBP]

Generated code corresponding to the number of the subplot.

When collected: On all plots where P2 vegetation is being sampled (P2 VEGETATION SAMPLING STATUS = 1 or 2)
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values:

1	Center subplot
2	North subplot
3	Southeast subplot
4	Southwest subplot

8.3.2 CONDITION CLASS NUMBER (CORE OPTIONAL 8.4.4) [CONDID]

Record the number for the sampled condition class in which the vegetation is found. If multiple sampled conditions occur on the same subplot, data will be collected for each condition separately.

When collected: Any accessible condition class when P2 vegetation is being sampled on accessible forest land conditions (P2 VEGETATION SAMPLING STATUS =1)

Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values: 1 to 9

8.3.3 VEGETATION SUBPLOT NOTES (CORE OPTIONAL 8.4.5) [NOTES]

Use this field to record notes pertaining to the subplot, and any unusual conditions encountered.

When collected: VEGETATION NONSAMPLED REASON = 10 or as needed
Field width: 2000 alphanumeric characters
Tolerance: N/A
MQO: N/A
Values: English language words, phrases, and numbers

8.4 Vegetation Structure

In this section, use ocular methods to estimate canopy cover by layer and aerial view coverage for each growth habit, and record to the nearest percent.

Canopy cover by layer:

Estimate the canopy cover for each of the four layers. Include growth habits present on the condition and any foliar parts overhanging the condition. For each layer cover, examine the canopy cover of each growth habit as if the other growth habits do not exist. Do not double count overlapping layers within a growth habit; visualize the cover layer collapsed into a 2-dimensional space. If a growth habit group does not have foliage in a layer, enter 0 (do not count tree boles as cover).

Aerial View Coverage:

Determine the total canopy cover by growth habit (trees, shrubs, forbs, and graminoids). Examine each growth habit individually as if the other growth habits do not exist. Do not double count overlapping layers within a growth habit (maximum cover=100%). To determine, estimate the area of ground surface covered by a vertically-projected polygon, described by the outline of the foliage, ignoring any normal spaces occurring between the leaves of plants (Daubenmire 1959) for the particular growth habit (fig.20) Assessing Canopy Cover).

Cover is estimated for each sampled condition of the subplot. If multiple sampled conditions occur on a subplot, treat the condition boundary as a vertical wall on the plot: **plant foliage is included in the condition it is hanging over**, even if the plant is rooted in a different condition. However, the foliage **cover value is always estimated as a percent of an entire subplot**. That is, if the cover of a growth habit within the condition is about equal to a circle with a radius of 5.3 feet, the cover estimate will always be 5 percent, even if only 30 percent of the subplot is in the condition on which the species is being measured.

The total cover for a specific growth habit must be equal to or greater than the highest cover recorded for an individual layer in that growth habit, but cannot be greater than the sum of the covers recorded for all the layers in that growth habit.

Vegetation Structure Growth Habits:

Apply the definitions that follow based on the species and appearance of the plants **on the subplot-condition** (i.e. do not put the same species in multiple growth habits on the same subplot-condition). If a tree species has been selected as a tally tree by the particular FIA unit, always record that species in the tally tree species growth habit (TT), even if it grows as a shrub in some environments. Woody plants not on the unit's tally tree list may have a tree growth habit in some environments, and these should be recorded as non-tally tree species (NT). If the growth habit is shrub in another environment, record that species as a shrub (SH). The definitions (adapted from NRCS PLANTS) are:

TT **Tally Tree Species (TT):** All core tree species **and** any core-optional tree species selected by a particular FIA unit. Any plant of that species is included, regardless of its shape and regardless of whether it was tallied on the subplot or microplot during tree tally (plants with canopy hanging into the subplot). Seedlings, saplings, and mature plants are included.

NT **Non-tally Tree Species (NT):** Tree species not on a particular FIA unit's tree tally list that are woody plants with a single stem, not supported by other vegetation or structures (not vines), and which are, or are expected to become, greater than 13 feet in height. Seedlings, saplings, and mature plants are included.

SH **Shrubs:/Woody Vines (SH):** Woody, multiple-stemmed plants of any size, and vines. Most cacti are included in this category.

FB **Forbs (FB):** Herbaceous, broad-leaved plants; includes non-woody-vines, ferns (does not include mosses and cryptobiotic crusts).

GR **Graminoids (GR):** Grasses and grass-like plants (includes rushes and sedges).

8.4.1 TALLY TREE SPECIES COVER LAYER 1 (CORE OPTIONAL 8.5.1) [TREE_COVER_PCT_LAYER1]

Record a total canopy coverage for all tally tree species in layer 1 (0-2.0 feet) to the nearest percent. Cover includes all tally tree species present, regardless of DBH or DRC.

When Collected: On all conditions within subplots where (P2 VEGETATION SAMPLING STATUS=1 and CONDITION CLASS STATUS = 1) or (P2 VEGETATION SAMPLING STATUS=2 and NONFOREST CONDITION STATUS=2)
Field Width: 3 digits
Tolerance: +/- 1 class based on the following canopy cover classes: 1%, 2-5%, 6-10%, 11-25%, 26-50%, 51-75%, 76-95%, 96-100%
MQO: at least 90% of the time
Values: 000-100

8.4.2 TALLY TREE SPECIES COVER LAYER 2 (CORE OPTIONAL 8.5.2) [TREE_COVER_PCT_LAYER2]

Record a total canopy coverage for all tally tree species in layer 2 (2.1- 6.0 feet) to the nearest percent. Cover includes all tally tree species present, regardless of DBH or DRC. Follow the same procedures as for TALLY TREE SPECIES COVER LAYER 1.

8.4.3 TALLY TREE SPECIES COVER LAYER 3 (CORE OPTIONAL 8.5.3) [TREE_COVER_PCT_LAYER3]

Record a total canopy cover for all tally tree species in layer 3 (6.1- 16.0 feet) to the nearest percent. Cover includes all tally tree species present, regardless of DBH or DRC. Follow the same procedures as for TALLY TREE SPECIES COVER LAYER 1.

8.4.4 TALLY TREE SPECIES COVER LAYER 4 (CORE OPTIONAL 8.5.4) [TREE_COVER_PCT_LAYER4]

Record a total canopy cover for all tally tree species in layer 4 (16.1 feet and above) to the nearest percent. Cover includes all tally tree species present, regardless of DBH or DRC. Follow the same procedures as for TALLY TREE SPECIES COVER LAYER 1.

8.4.5 TALLY TREE SPECIES COVER – AERIAL VIEW (CORE OPTIONAL 8.5.5) [TREE_COVER_PCT_AERIAL]

Record the total canopy cover for all tally tree species over all layers. Cover includes all tally tree species present, regardless of DBH or DRC. Follow the same procedures as for TALLY TREE SPECIES COVER LAYER 1, but include all layers.

8.4.6 NON-TALLY TREE SPECIES COVER LAYER 1 (CORE OPTIONAL 8.5.6) [NONTALLY_TREE_COVER_PCT_LAYER1]

Record a total canopy coverage for species **not** on the tally tree species list with tree growth habit in layer 1 (0-2.0 feet) to the nearest percent. Cover includes all non-tally tree species present, regardless of DBH or DRC.

When Collected: On all conditions within subplots where (P2 VEGETATION SAMPLING STATUS=1 and CONDITION CLASS STATUS = 1) or (P2 VEGETATION SAMPLING STATUS=2 and NONFOREST CONDITION STATUS=2)

Field Width: 3 digits
Tolerance: +/- 1 class based on the following canopy cover classes: 1%, 2-5%, 6-10%, 11-25%, 26-50%, 51-75%, 76-95%, 96-100%
MQO: at least 90% of the time
Values: 000-100

8.4.7 NON-TALLY TREE SPECIES COVER LAYER 2 (CORE OPTIONAL 8.5.7) [NONTALLY_TREE_COVER_PCT_LAYER2]

Record a total canopy coverage for species **not** on the tally tree species list with tree growth form in layer 2 (2.1- 6.0 feet) to the nearest percent. Cover includes all non-tally tree species present, regardless of DBH or DRC. Follow the same procedures as for NON-TALLY TREE SPECIES COVER LAYER 1.

8.4.8 NON-TALLY TREE SPECIES COVER LAYER 3 (CORE OPTIONAL 8.5.8) [NONTALLY_TREE_COVER_PCT_LAYER3]

Record a total canopy cover for species **not** on the tally tree species list with tree growth form in layer 3 (6.1- 16.0 feet) to the nearest percent. Cover includes all non-tally tree species present, regardless of DBH or DRC. Follow the same procedures as for NON-TALLY TREE SPECIES COVER LAYER 1.

8.4.9 NON-TALLY TREE SPECIES COVER LAYER 4 (CORE OPTIONAL 8.5.9) [NONTALLY_TREE_COVER_PCT_LAYER4

Record a total canopy cover for species **not** on the tally tree species list with tree growth habit in layer 4 (16.1 feet and above) to the nearest percent. Cover includes all non-tally tree species present, regardless of DBH or DRC. Follow the same procedures as for NON-TALLY TREE SPECIES COVER LAYER 1.

8.4.10 NON-TALLY TREE SPECIES COVER – AERIAL VIEW (CORE OPTIONAL 8.5.10) [NONTALLY_TREE_COVER_PCT_AERIAL

Record the total canopy cover for species **not** on the tally tree species list with tree growth habit over all layers. Cover includes all non-tally tree species present, regardless of DBH or DRC. Follow the same procedures as for NON-TALLY TREE SPECIES COVER LAYER 1.

8.4.11 SHRUB AND WOODY VINE COVER LAYER 1 (CORE OPTIONAL 8.5.11) [SHRUB_VINE_COVER_PCT_LAYER1]

Record a total canopy coverage for shrubs in layer 1 (0-2.0 feet) to the nearest percent.

> When collected: On all conditions within subplots where (P2 VEGETATION SAMPLING STATUS=1 and CONDITION CLASS STATUS = 1) or (P2 VEGETATION SAMPLING STATUS=2 and NONFOREST CONDITION STATUS=2)
>
> Field width: 3 digits
> Tolerance: +/- 1 class based on the following canopy cover classes: 1%, 2-5%, 6-10%, 11-25%, 26-50%, 51-75%, 76-95%, 96-100%
> MQO: at least 90% of the time
> Values: 000-100

8.4.12 SHRUB AND WOODY VINE COVER LAYER 2 (CORE OPTIONAL 8.5.12) [SHRUB_VINE_COVER_PCT_LAYER2]

Record a total canopy coverage for shrubs in layer 2 (2.1-6.0 feet) to the nearest percent. Follow the same procedures as for SHRUB AND WOODY VINE COVER LAYER 1.

8.4.13 SHRUB AND WOODY VINE COVER LAYER 3 (CORE OPTIONAL 8.5.13) [SHRUB_VINE_COVER_PCT_LAYER3]

Record a total canopy coverage for shrubs in layer 3 (6.1-16.0 feet) to the nearest percent. Follow the same procedures as for SHRUB AND WOODY VINE COVER LAYER 1.

8.4.14 SHRUB AND WOODY VINE COVER LAYER 4 (CORE OPTIONAL 8.5.14) [SHRUB_VINE_COVER_PCT_LAYER4]

Record a total canopy coverage for shrubs in layer 4 (16.1 feet and above) to the nearest percent. Follow the same procedures as for SHRUB AND WOODY VINE COVER LAYER 1.

8.4.15 SHRUB AND WOODY VINE COVER—AERIAL VIEW (CORE OPTIONAL 8.5.15) [SHRUB_VINE_COVER_PCT_AERIAL]

Record the total canopy cover for the shrub/ woody vine growth habit over all layers. Follow the same procedures as for SHRUB AND WOODY VINE COVER LAYER 1, but include all layers.

8.4.16 FORB COVER LAYER 1 CORE OPTIONAL 8.5.16) [FORB_COVER_PCT_LAYER1]
Record a total canopy coverage for forbs in layer 1 (0-2.0 feet) to the nearest percent.

> When collected: On all conditions within subplots where (P2 VEGETATION SAMPLING STATUS=1 and CONDITION CLASS STATUS = 1) or (P2 VEGETATION SAMPLING STATUS=2 and NONFOREST CONDITION STATUS=2)
>
> Field width: 3 digits
> Tolerance: +/- 1 class based on the following canopy cover classes: 1%, 2-5%, 6-10%, 11-25%, 26-50%, 51-75%, 76-95%, 96-100%
> MQO: at least 90% of the time
> Values: 000-100

8.4.17 FORB COVER LAYER 2 (CORE OPTIONAL 8.5.17) [FORB_COVER_PCT_LAYER2]
Record a total canopy coverage for forbs in layer 2 (2.1-6.0 feet) to the nearest percent. Follow the same procedures as for FORB COVER LAYER 1.

8.4.18 FORB COVER LAYER 3 (CORE OPTIONAL 8.5.18) [FORB_COVER_PCT_LAYER3]
Record a total canopy coverage for forbs in layer 3 (6.1-16.0 feet) to the nearest percent. Follow the same procedures as for FORB COVER LAYER 1.

8.4.19 FORB COVER LAYER 4 (CORE OPTIONAL 8.5.19) [FORB_COVER_PCT_LAYER4]
Record a total canopy coverage for forbs in layer 4 (16.1 feet and above) to the nearest percent. Follow the same procedures as for FORB COVER LAYER 1.

8.4.20 FORB COVER—AERIAL VIEW (CORE OPTIONAL 8.5.20) [FORB_COVER_PCT_AERIAL]
Record the total canopy cover for the forb growth habit over all layers. Follow the same procedures as for FORB COVER LAYER 1.

8.4.21 GRAMINOID COVER LAYER 1 (CORE OPTIONAL 8.5.21) [GRAMINOID_COVER_PCT_LAYER1]
Record a total canopy coverage for graminoids in layer 1 (0-2.0 feet) to the nearest percent.

> When collected: On all conditions within subplots where (P2 VEGETATION SAMPLING STATUS=1 and CONDITION CLASS STATUS = 1) or (P2 VEGETATION SAMPLING STATUS=2 and NONFOREST CONDITION STATUS=2)
>
> Field width: 3 digits
> Tolerance: +/- 1 class based on the following canopy cover classes: 1%, 2-5%, 6-10%, 11-25%, 26-50%, 51-75%, 76-95%, 96-100%
> MQO: at least 90% of the time
> Values: 000-100

8.4.22 GRAMINOID COVER LAYER 2 (CORE OPTIONAL 8.5.22) [GRAMINOID_COVER_PCT_LAYER2]
Record a total canopy coverage for graminoids in layer 2 (2.1-6.0 feet) to the nearest percent. Follow the same procedures as for GRAMINOID COVER LAYER 1.

8.4.23 GRAMINOID COVER LAYER 3 (CORE OPTIONAL 8.5.23) [GRAMINOID_COVER_PCT_LAYER3]

Record a total canopy coverage for graminoids in layer 3 (6.1-16.0 feet) to the nearest percent. Follow the same procedures as for GRAMINOID COVER LAYER 1.

8.4.24 GRAMINOID COVER LAYER 4 (CORE OPTIONAL 8.5.24) [GRAMINOID_COVER_PCT_LAYER4]

Record a total canopy coverage for graminoids in layer 4 (16.1 feet and above) to the nearest percent. Follow the same procedures as for GRAMINOID COVER LAYER 1.

8.4.25 GRAMINOID COVER—AERIAL VIEW (CORE OPTIONAL 8.5.25) [GRAMINOID_COVER_PCT_LAYER_AERIAL]

Record the total canopy cover for the graminoid growth habit over all layers. Follow the same procedures as for GRAMINOID COVER LAYER 1.

8.4.26 MOSS/BRYOPHYTE COVER LAYER 1 (HAWAII) [MOSS_BRYO_COVER_PCT_PNWRS]

Record the total canopy cover for mosses/bryophytes in layer 1(0-2.0 feet) to the nearest percent. Individual species will not be recorded, only layer 1 will be assessed, and there is no GROWTH HABIT for this data item. This is all that will be collected for Moss/Bryophytes.

> When collected: On all conditions within subplots where (P2 VEGETATION SAMPLING STATUS=1 and CONDITION CLASS STATUS = 1) or (P2 VEGETATION SAMPLING STATUS=2 and NONFOREST CONDITION STATUS=2)
>
> Field width: 3 digits
> Tolerance: +/- 1 class based on the following canopy cover classes: 1%, 2-5%, 6-10%, 11-25%, 26-50%, 51-75%, 76-95%, 96-100%
> MQO: at least 90% of the time
> Values: 000-100

8.5 Species Composition

Species are recorded when LEVEL OF DETAIL = 2 or 3. Identify the four most abundant species within each growth habit group (tree seedlings and saplings, shrubs/woody vines, forbs, graminoids, and overstory trees) that occupy 3 percent or greater canopy cover on the subplot. Although up to four species with cover of at least 3 percent per growth habit can be recorded, crews should not spend more than 5 minutes searching for additional species when less than four species are not readily observable. The methods described assume that only one field crew member per plot is entering vegetation profile data. Other crew members may assist with assessments, but data entry by only one person is highly recommended.

When there are multiple conditions within a subplot, the species must be present at 3 percent or more cover on the full 24-foot radius subplot in order to be recorded. If part of the subplot is a non-sampled condition (e.g., nonforest or inaccessible), estimate cover for the full subplot if possible; otherwise assume the species density is the same on the non-sampled portion. If a species is present at 3 percent cover or more on the full subplot, record species and cover separately for each condition, by only including cover within a vertical projection of the condition boundary within a subplot. Cover percentages are always fixed on the full subplot area, regardless of condition proportion. For example, on a subplot with two sampled conditions, a species occurs with a cover equal to a circle with a radius of 7.6 feet on the full subplot, or 10 percent cover, so it is recorded. On condition class #1, it covers an area equal to a circle of 2.4-foot radius and is recorded as 1 percent cover. The remainder, 9 percent cover, is recorded for condition #2. Cover values less than 3 percent for a condition that occupies part of a subplot are valid as long as the cover of the species on the full subplot is at least 3 percent. See figure 22 (example of species cover estimation) for an example.

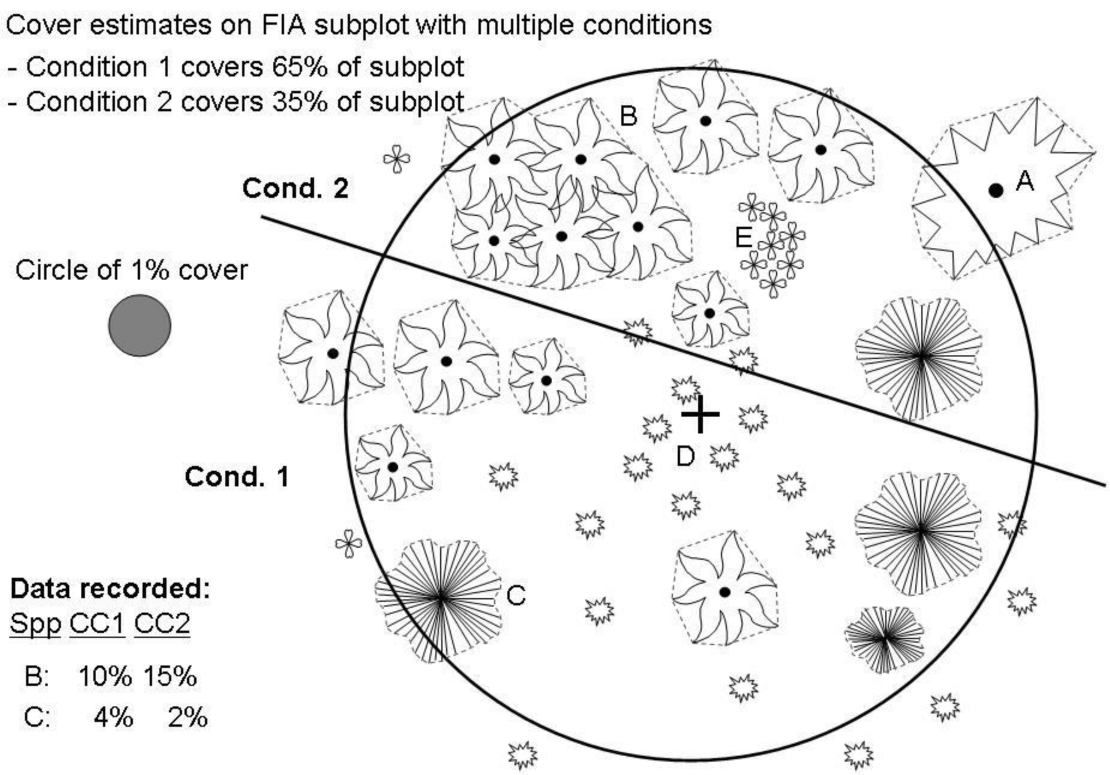


Figure 22. Example of species cover estimation on a subplot with 2 conditions. See figure 20 for total cover across the subplot. In figure 20, species A, D, and E would be included in estimates of vegetation structure by growth habit, but not recorded for species composition. Note that species with subplot cover <3% are not recorded, but that cover recorded on a condition can be less than 3%.

8.5.1 SPECIES GROWTH HABIT (CORE OPTIONAL 8.6.1) [GROWTH_HABIT_CD]

Record the growth habit of the species. Tally tree species are always recorded as trees, even when they exhibit a shrub-like growth habit. However, because many species can exhibit various growth habits, it is important to note which growth habit each recorded species is demonstrating on the current condition. If a species has more than one growth habit on a condition in a subplot, record the one which is most prevalent; however, both tree habits (SD and LT) can be coded for the same species if LEVEL OF DETAIL=3 and the species is found in both size classes. A species may be recorded with a different growth habit on a different subplot-condition on the same plot.

When collected: LEVEL OF DETAIL = 2 or 3, and for each species recorded below.
Field width: 2 alphanumeric characters
Tolerance: No errors
MQO: At least 95% of the time
Values:

SD Seedlings Saplings: Small trees less than 5 inches DBH or DRC, including tally and non-tally tree species. Up to four species are included if individual species total cover is at least 3% of subplot area when LEVEL Of DETAIL = 2 or LEVEL Of DETAIL =3.

SH Shrubs:/Woody Vines: Woody, multiple-stemmed plants of any size, and vines. Most cacti are included in this category. Up to four species are recorded if individual species total cover is at least 3% of the subplot area when LEVEL Of DETAIL = 2 or LEVEL Of DETAIL =3.

FB Forbs: Herbaceous, broad-leaved plants; includes non-woody-vines, ferns (does not include mosses and cryptobiotic crusts). Up to four species are recorded if individual species total cover is at least 3% of the subplot area when LEVEL Of DETAIL = 2 or LEVEL Of DETAIL =3.

GR Graminoids: Grasses and grass-like plants (includes rushes and sedges). Up to four species are recorded if individual species total cover is at least 3% of the subplot area when LEVEL Of DETAIL = 2 or LEVEL Of DETAIL =3.

LT Large Trees: Up to four species of large trees (DBH or DRC at least 5 inches) are recorded if individual species cover is at least 3% of the subplot area, including both tally and non-tally tree species, when LEVEL Of DETAIL = 3.

8.5.2 SPECIES CODE (CORE OPTIONAL 8.6.2) [VEG-FLDSPCD]

Record a code for each sampled vascular plant species found rooted in or overhanging the sampled condition of the subplot at any height. Species codes must be the standardized codes in the Natural Resource Conservation Service (NRCS) PLANTS database (currently January 2010 version). Identification to species only is expected. However, if subspecies information is known, enter the appropriate NRCS code. For graminoids, genus and unknown codes are acceptable, but do not lump species of the same genera or unknown code. For example, if several unknown CAREX species are present, only record the individual species present with cover of at least 3 percent.

If a plant cannot be identified quickly and confidently, assign a NRCS PLANTS genus or unknown code appropriate to the species. Collect a specimen away from the subplot unless the species is locally sparse or another SPECIMEN NOT COLLECTED REASON CODE (8.5.8) applies. A species is "locally sparse" if 5 or fewer plants are present in the entire plot (4 subplots) and immediate surrounding area. A species may be sparse and still meet the criteria for inclusion in species composition, but this will be rare.

Acceptable unknown codes

Code	Common Name
2FERN	Fern or Fern Ally
2FORB	Forb (herbaceous, not grass nor grass-like)
2FD	Forb, dicot
2FM	Forb, monocot
2GRAM	Graminoid (grass or grass-like)
2GA	Grass, annual
2GP	Grass, perennial
2GL	Grass-like, (sedges and rushes)
2PLANT	Plant
2SHRUB	Shrub (>.5m)
2SUBS	Subshrub (<.5m)
2TREE	Tree
2VH	Vine, herbaceous
2VW	Vine, woody

When collected: LEVEL OF DETAIL = 2 or 3 and species canopy cover on the full subplot is 3% or greater.
Field width: 8 alpha-numeric characters
Tolerance: No errors
MQO: At least 80% of the time
Values: Accepted NRCS species code when the species is known, or an accepted NRCS genus or unknown code when the species is not known

8.5.3 UNIQUE SPECIES NUMBER (CORE OPTIONAL 8.6.3) [UNIQUE_SP_NBR]

When any code is entered for the first time on a plot, it is assigned UNIQUE SPECIES NUMBER = 1. If more than one unidentified species is discovered that is described by the same genus or unknown code, the next sequential number is assigned. If a recorded unidentified species is encountered again elsewhere on the plot, the field crew records the species with the same genus or unknown code with the same unique species number.

When collected: All species recorded
Field width: 2 digits
Tolerance: No errors
MQO: At least 99% of the time
Values: 1-99, assigned in sequential numbers

8.5.4 SPECIES CANOPY COVER (CORE OPTIONAL 8.6.4) [COVER_PCT]

For each species recorded, estimate and record the canopy cover present on the subplot-condition to the nearest 1 percent (note: cover is always recorded as a percent of the full subplot area, even if the condition being assessed does not cover the full subplot—see example under item 8.5 Species Composition). Canopy cover is identified as the area of ground surface covered by the outline of the foliage, ignoring any normal spaces occurring between the leaves of plants (Daubenmire 1959) by the canopy of each plant species (fig. 20 Assessing Canopy Cover). Do not count overlapping crowns within a species. When recording cover for seedlings and saplings (SPECIES GROWTH HABIT=SD), do not include any canopy from trees greater than or equal to 5 inches DBH (DRC for woodland species), regardless of how close to the ground the canopy extends. When LEVEL OF DETAIL=3, a separate estimate is made for the canopy of trees greater than or equal to 5 inches DBH/DRC.

When collected: For each plant species present on the subplot with canopy cover greater than or equal to 3%. A plant species is defined as a unique SPECIES CODE and UNIQUE SPECIES NUMBER pair.

Field width: 3 digits
Tolerance: +/- 1 class based on the following canopy cover classes: 1%, 2-5%, 6-10%, 11-25%, 26-50%, 51-75%, 76-95%, 96-100%
MQO: at least 90% of the time
Values: 001-100

8.5.5 SPECIES VEGETATION LAYER (CORE OPTIONAL 8.6.5) [LAYER]

For each individual species recorded, assign one of the vegetation layers. These layers illustrate the vertical diversity of the predominant species found on the subplot.

Assign each plant species record to only one of the vegetation layers. If a plant species in a growth habit is found in more than one layer, assign the entire plant to the layer where most of the cover occurs. If a species occupies multiple layers equally, assign the highest of the equally occupied layers. If a plant has a seed head that grows much taller than the rest of the plant, record the layer that the main part of the plant is in, not the top of the seed head.

When collected: For each species recorded.
Field width: 1 digits
Tolerance: No errors
MQO: At least 90% of the time
Values: 1-4

1	0 to 2.0 feet
2	2.1 to 6.0 feet
3	6.1 to 16.0 feet
4	Greater than 16 feet

8.5.6 SPECIMEN OFFICIALLY COLLECTED (CORE OPTIONAL 8.6.6) [SPECIMEN_COLLECTED]

Record if a specimen was collected or not for each species, genus or unknown code entered as a new unique species.

When collected: All species recorded
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values

0	No, a specimen was not collected
1	Yes, a specimen was collected

8.5.7 SPECIMEN LABEL NUMBER (CORE OPTIONAL 8.6.7) [SPECIMEN_LABEL_NBR]

Record the label number for the collected specimen. Pre-numbered labels are provided to each crew by the regional coordinator.

When collected: SPECIMEN OFFICIALLY COLLECTED = 1
Field width: 5 digits
Tolerance: No errors
MQO: At least 99% of the time
Values: 1 to 99999, as pre-printed and assigned by region

8.5.8 P2 SPECIMEN NOT COLLECTED REASON CODE (CORE OPTIONAL 8.6.8) [SPECIMEN_NOT_COLLECTED_REASON]

Record the code that describes why a specimen has not been collected.

When collected: An unknown code or genus code is entered and SPECIMEN OFFICIALLY COLLECTED = 0
Field width: 2 digits
Tolerance: No errors
MQO: At least 99% of the time
Values:

01	Species is locally sparse (fewer than 5 individual plants in area of the plot)
02	Species has no mature foliage or reproductive parts present, so is unlikely to be identifiable if collected.
03	Hazardous situation
04	Time limitation
05	Wilderness or reserved land where plant collections are not allowed
06	Specimen collected for immediate/local identification
07	Not required by inventory unit
10	Other (explain in notes)

8.5.9 VEGETATION SPECIES NOTES (CORE OPTIONAL 8.6.9) [NOTES]

Notes may be entered for any species encountered, but are required for each new species that is not identified. Enter text that describes the species. This text may be used in the specimen label and unknown report.

When collected: As needed
Field width: 2000 characters
Tolerance: N/A
MQO: N/A
Values: English language words, phrases, and numbers

8.5.10 VEGETATION SPECIMEN LABEL COMMUNITY DESCRIPTION (HAWAII) [COMMUNITY_DESC_SPECIMEN-LABEL]

Any time a specimen is collected, a subplot community description must be recorded, whether for P2 veg, P3 veg or an invasives species. Access the data item on the PDR via the CTRL E option from the subplot screen.

When collected: When Specimen Officially Collected = 1
Field width: 2000 characters
Tolerance: N/A
MQO: N/A
Values: English language words, phrases, and numbers

8.6 INVASIVE PLANTS

The objectives of the Phase 2 (P2) invasive plants protocol are to document abundance and monitor changes in abundance of selected species over time. Combined with other plot data and other datasets, this data can be used to predict the future spread of selected species. Invasive plant species are having tremendous economic and ecological impacts on our nation's forests, and the impacts are increasing over time. Providing accurate, statistically valid estimates of the distribution and abundance of some of the most damaging species will give managers and policy-makers a better understanding of the problem than they would otherwise have.

Each FIA unit, in collaboration with vegetation experts, has developed lists of the most important invasive species to monitor on forested lands. Depending on local needs or forest conditions, there may be different lists of species for individual states or portions of states. Changes to the species on these lists are managed by the individual FIA units using local change procedures. However, when an FIA unit samples invasive species, they will use the field protocols contained in this chapter.

Data will be collected by crew members who have been trained and certified in the Invasive plants protocol methods. These crew members are expected to have field guides that allow for unambiguous identification of the plant species on the list they are to use, and training in field identification and cover estimation of those species under different conditions.

Note: Avoid becoming part of the problem! There is a risk that field crews walking into plot locations could pick up seeds along roadsides or other patches of invasive plants and spread them through the forest and on to the plot. Be aware of the vegetation you are traveling through and consider stopping and removing seeds from boots and clothing before entering uninvaded lands, particularly remote areas that are rarely visited.

8.7 Invasive species sample design

Phase 2 sampling of invasive species is most often focused on accessible forest condition classes within the 24.0-foot radius subplot. If the total area of all accessible forest land condition classes is less than 100 percent on a subplot, **invasive species measurements are done only on the portion that is in accessible forest land condition classes**. If multiple accessible forested condition classes are present on the subplot, separate estimates are made for each condition class on the subplot. Canopy cover estimates are only made for the area within accessible forest condition(s)—for example, vegetation cover over-hanging a nonforest road condition is not included in the estimate.

However, each FIA unit has the **option to also sample invasive species on accessible nonforest land conditions (condition status 2)**, where desired or funded by specific landowners (e.g., on some National Forests in the West). Where this is done, estimates of invasive species abundance are maintained separately on forest and nonforest conditions.

Canopy cover is estimated for any listed invasive species present on the measured condition(s) of a subplot, regardless of abundance (i.e., there is not minimum cover threshold for sampling). When crews are not sure about the identification of a plant that might be a listed invasive, they are encouraged to collect specimens for later identification . Rules and expectations for plant collection and identification are specified by individual FIA units.

8.8 Species Records

The invasive plant recorder does a search of each measured condition on the subplot. **Only** listed species rooted in or overhanging (and rooted out of) this condition are included. For tree species, there are no minimum (or maximum) height limits as are required for seedling counts. All vegetation and plant parts that are or were alive during the current growing season are included in the cover estimates (e.g., brown Canada thistle in late summer is counted, live buds on Russian olive in late fall are used to estimate crown cover).

Total cover is estimated on measured conditions on each 24.0-foot radius subplot for every species on the invasive plant list found. If multiple conditions are being sampled on the same subplot, separate cover estimates for every species must be made .

8.9 SUBPLOT NUMBER (CORE OPTIONAL 9.4) [SUBP]

Record the code corresponding to the number of the subplot.

When collected: On all subplots where INVASIVE PLANT SAMPLING STATUS = 1 or 2
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values:

1 Center subplot
2 North subplot
3 Southeast subplot
4 Southwest subplot

8.10 INVASIVE PLANT DATA NOTES (CORE OPTIONAL 9.7) [NOTES]

Use this field to record any notes about the condition on the subplot, particularly any unusual conditions encountered.

When collected: INVASIVE PLANT NONSAMPLED REASON=10 or as needed
Field width: 2000 Characters
Tolerance: N/A
MQO: N/A
Values: English language words, phrases, and numbers

8.11 CONDITION CLASS NUMBER (CORE OPTIONAL 9.8) [CONDID]

Record the number for the measured condition class in which the invasive plant(s) is found. If multiple measured conditions occur on the same subplot, data will be collected for each condition separately.

When collected: Any condition class where (INVASIVE PLANT SAMPLING STATUS=1 and CONDITION CLASS STATUS=1) or (INVASIVE PLANT SAMPLING STATUS=2 and NONFOREST CONDITION CLASS STATUS=2).

Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values: 1-9

8.12 SPECIES CODE (CORE OPTIONAL 9.9) [VEG_FLDSPD]

Record the code for any species listed below that is found rooted in or overhanging (and rooted out of) the measured condition within the subplot. Species codes must be the standardized codes in the Natural Resource Conservation Service (NRCS) PLANTS database January 2010 version maintained by the FIA IM group (USDA, NRCS. 2010. The PLANTS database [http://plants.usda.gov/plants]. National Plant Data Center, Baton Rouge, LA 70874-4490).

In many of the invasive plant ID guides used by FIA units, some species are grouped together in the ID descriptions, and it may be difficult to distinguish between them with the information provided. In addition, some plants may be hybrids of listed species. Enter the code for the most likely species in the group, or the first one in the group if you are not sure.

If a species is suspected of being a listed invasive but cannot be identified quickly and confidently, and the FIA unit's protocols require specimen collection, assign a NRCS PLANTS unknown code. A subset of acceptable unknown codes that can be used is listed below. Collect a specimen unless the species is locally sparse. A species is "locally sparse" if five or fewer plants are present in the entire plot (4 subplots) and immediate surrounding area.

When collected: On all conditions within subplots where INVASIVE PLANT SUBPLOT STATUS=1 and ((INVASIVE PLANT SAMPLING STATUS=1 and CONDITION CLASS STATUS=1) or (INVASIVE PLANT SAMPLING STATUS=2 and NONFOREST CONDITION CLASS STATUS=2)).

Field width: 8 alpha-numeric characters
Tolerance: No errors
MQO: At least 99% of the time
Values: See list of known and unknown species below

Unknown Code	Common Name
2FERN	Fern or Fern Ally
2FORB	Forb (herbaceous, not grass nor grass-like)
2FD	Forb, dicot
2FM	Forb, monocot
2GRAM	Graminoid (grass or grass-like)
2GA	Grass, annual
2GP	Grass, perennial
2GL	Grass-like, (sedges and rushes)
2PLANT	Plant
2SHRUB	Shrub (>.5m)
2SUBS	Subshrub (<.5m)
2TREE	Tree
2VH	Vine, herbaceous
2VW	Vine, woody

Scientific name	**Common name**	**Code**
Ailanthus altissima	Tree of Heaven	AIAL
Albizia julibrissin	Silktree	ALJU
Ardisia elliptica	shoebutton	AREL4
Bocconia frutescens	parrotweed	BOFR2
Cestrum nocturnum	night jasmine	CENO
Clidemia hirta	koster's curse	CLHI3
Cyathea cooperi	Australian tree fern	CYCO18
Falcataria moluccana	peacocksplume	FAMO
Ficus microcarpa	Chinese banyan	FIMI2
Ficus rubiginosa	Port Jackson fig	FIRU4
Grevillea robusta	silkoak	GRRO
Hedychium gardnerianum	kahili ginger	HEGA
Lantana camara	lantana	LACA2
Leptospermum scoparium	New Zealand tea tree	LESC2
Leucaena leucocephala	koa haole	LELE10
Melastoma candidum	melastoma	MECA9
Melaleuca quinquenervia	Chinaberry	MEQU
Melia azedarach	Punktree	MEAZ
Miconia calvescens	miconia	MICA20
Morella faya	*Myrica faya*	MOFA
Passiflora tripartita var. mollissima	banana poka	PATRM
Paulownia tomentosa	Princess Tree	PATO2
Pennisetum setaceum	fountaingrass	PESE3
Psidium cattleianum	strawberry guava	PSCA
Psidium guajava	guava	PSGU
Rauvolfia vomitoria	poison devil's pepper	RAVO
Rhodomyrtus tomentosa	downy rosemyrtle	RHTO10
Rubus argutus	prickly Florida blackberry	RUAR2
Rubus ellipticus var. obcordatus	yellow Himalayan raspberry	RUELO
Rubus glaucus	raspberry	RUGL5
Rubus niveus	hill raspberry	RUNI4
Schinus terebinthifolius	Brazilian pepper-tree	SCTE
Setaria palmifolia	palmgrass	SEPA6
Spathodea campanulata	African tulip tree	SPCA2
Tibouchina herbacea	tibouchina	TIHE2
Triadica sebifera	Tallow tree	TRSE6
Ulmus pumila	Siberian elm	ULPU

8.13 UNIQUE SPECIES NUMBER (CORE OPTIONAL 9.10) [UNIQUE_SP_NBR]

When any species code is entered for the first time on a plot, the UNIQUE SPECIES NUMBER assigned is “1”. If more than one unidentified species is recorded that is described by the same unknown code, the next sequential number is assigned. If a previously-recorded unidentified species is encountered again elsewhere on the plot, the UNIQUE SPECIES NUMBER that corresponds to the earlier encountered specimen must be entered. For example, an unknown thistle and unknown hawkweed would both be given a species code of “2FORB” but would need to be given different UNIQUE SPECIES NUMBERs when measured.

When collected: All species records
Field width: 2 digits
Tolerance: No errors
MQO: At least 99% of the time
Values: 1-99, assigned in sequential numbers

8.14 SPECIES CANOPY COVER (CORE OPTIONAL 9.11) [COVER_PCT]

A rapid canopy cover estimate, to the nearest percent cover, is made for each species for all foliage across all layer heights. All vegetation and plant parts that are or were alive during the current growing season are included in the cover estimates (e.g. brown Canada thistle in late summer is counted, live buds on Russian olive in late fall are used to estimate crown cover). **Canopy cover is based on a vertically-projected polygon described by the outline of the foliage**, ignoring any normal spaces occurring between the leaves of plants (Daubenmire 1959), and ignoring overlap among multiple layers of a species. Canopy cover estimates are only made for the area within each measured condition (for example, vegetation cover over-hanging a nonforest road condition is not included in the adjacent forested condition estimate.)

For each species, cover can never exceed 100 percent. Cover is estimated for each measured condition on the subplot separately. However, the foliage **cover is always estimated as a percent of an entire subplot**. For example, on a subplot with two sampled conditions, a species occurs with a cover equal to a circle with a radius of 7.6 feet on the full subplot, or 10 percent cover. On condition class number 1 it covers an area equal to a circle of 2.4 feet radius and is recorded as 1 percent cover. The remainder, 9 percent cover, is recorded for condition number 2. If the species is only present on condition class number 1 with an area equal to a circle of 2.4-feet radius it is recorded as 1 percent. The proportion of the subplot in each condition does not matter.

If cover is greater than 0 but less than 1.5 percent, record as 1 percent cover. For species of moderate cover, it may be easiest to divide the subplots into quarters, estimate canopy cover of each quarter separately, and then add them together. The following area-cover sizes may be useful in developing estimates for an entirely forested subplot:

Subplot radius = 24.0 feet, Subplot area = 1809 ft^2			
Cover	Area (ft^2)	Length of a side of a square(ft)	Radius of circular area(ft)
1%	18	4.3	2.4
3%	54	7.4	4.1
5%	90	9.5	5.3
10%	181	13.4	7.6
20%	362	19	10.7

When collected: All species records
Field width: 3 digits
Tolerance: +/- 1 class based on the following canopy cover classes: 1%, 2-5%, 6-10%, 11-25%, 26-50%, 51-75%, 76-95%, 96-100%
MQO: At least 90% of the time
Values: 001 to 100

8.15 INVASIVE SPECIMEN COLLECTED (CORE OPTIONAL 9.13) [SPECIMEN_COLLECTED]

Record if a specimen was collected for each species or unknown code. If the record is an unknown code, your unit requires specimen collection, and a plant specimen is not collected, describe the reason it was not collected in INVASIVE PLANT NOTES.

When collected: Each record where INVASIVES PLANT SUBPLOT STATUS=1, INVASIVE PLANT SPECIMEN COLLECTION RULE = 1, and an unknown SPECIES CODE was used.
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time

Values:

0	No, a specimen was not officially collected
1	Yes, a specimen was officially collected

8.16 SPECIMEN LABEL NUMBER (CORE OPTIONAL 9.14) [SPECIMEN_LABEL_NBR]

Record the label number for the collected specimen. Where plant specimen collection is required, numbered labels are provided to each crew.

When collected: Where INVASIVE SPECIMEN COLLECTED=1
Field width: 5 digits
Tolerance: No errors
MQO: At least 99% of the time
Values: 1 to 99999, as pre-printed and assigned by FIA unit.

8.17 INVASIVE PLANT NOTES (CORE OPTIONAL 9.15) [NOTES]

Notes are **required** for each species record with an unknown code. Enter text that describes the species or that explains why it was not collected if collection was required but not done. This text may be used on the specimen label and any spreadsheet used to track specimens.

When collected: As needed: Required for each record with an unknown code and SPECIMEN LABEL NUMBER.
Field width: 2000 characters
Tolerance: N/A
MQO: N/A
Values: English language words, phrases, and numbers

8.18 References:

Daubenmire, R. 1959. A canopy-coverage method of vegetational analysis. Northwest Science 33(1): 43-64.

9. TRACKABLE TREE AND SNAG SELECTION

A. Introduction

Tree species are measured on accessible forested condition classes and measurable accessible nonforest condition classes. See page 60 for definitions of accessible forest land.

Trees and snags (≥5.0 in. d.b.h.) are sampled using the 1/24 acre fixed-radius subplot. Each subplot has a fixed-radius of 24.0 feet horizontal.

Saplings (1.0 in. to 4.9 in. d.b.h.) are sampled more efficiently using the small (1/300 acre) microplot. Each microplot has a fixed-radius of 6.8 feet horizontal. Saplings are referenced to the microplot center.

Seedlings (conifers <1.0 in. d.b.h. and ≥0.5 ft. in length; and hardwoods <1.0 in. d.b.h. and ≥1.0 ft. in length) are also sampled most efficiently using the microplot. Seedlings are counted by species and condition class (see "SEEDLING DATA" on page 103). Seedlings are referenced to the microplot center.

B. Determining if a tree/sapling/seedling is selected on a fixed-radius plot

Trees are selected only when the distance from their bole center at the ground to the subplot center is less than the radius of that subplot/microplot (see figure 23).

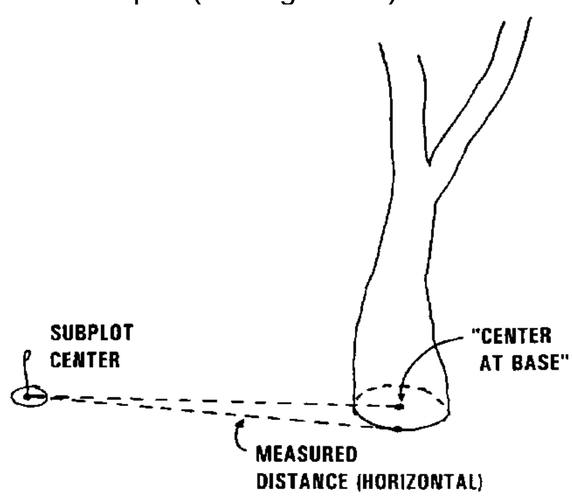


Fig.23

C. Trackable tree and snag selection

Is it a tree or a branch?:
See the rule for forked trees in tree data 10.16.2 DIAMETER AT BREAST HEIGHT on page 149.

Is it a stump?:
High stumps meeting size and lean requirements are considered standing dead tally trees and are tallied as such. Identify them as stumps in **TREE NOTES.**

Follow the steps below:

1.) If the condition class is accessible forest land (CONDITION STATUS = 1) or measured accessible nonforest (NONFOREST SAMPLING STATUS = 1 and CONDITION CLASS STATUS = 2 and NONFOREST CONDITION CLASS STATUS = 2), do the following steps in the condition class:

a) Tally all live and standing dead trees $\geq$5.0 in. d.b.h. that are within the 24.0 ft. subplot.

b) Tally all live trees 1.0 to 4.9 in. d.b.h. that are within the 6.8 ft. microplot.

c) Tally live seedlings (conifers <1.0 in. d.b.h. and $\geq$0.5 ft. in length; and hardwoods <1.0 in. d.b.h. and $\geq$1.0 ft. in length) present within the 6.8 ft. microplot.

2.) If the condition class is NOT accessible forest land or measured accessible nonforest (NONFOREST SAMPLING STATUS = 1 and CONDITION CLASS STATUS = 2 and NONFOREST CONDITION CLASS STATUS = 2):

Do not tally live trees, dead trees, or seedlings.

D. Microplots with excessive saplings

There are times when microplots will be full of saplings and will slow down production. This is often the case on plots with Strawberry Guava (Psidium cattleianum – SPECIES code 8355). When this is encountered on a microplot (generally –when there are 20 or more saplings) use the following procedures to help speed up the microplot tally:

1) Record “1” for HIGH TALLY SAPLING PROCEDURES for the associated microplot

2) Divide the microplot into four sections (azimuths 1-90, 91-180, 181-270, 271-360). Record an AZIMUTH of 45 for saplings that are at an azimuth between 1 and 90, 135 for saplings that are at an azimuth between 91 and 180, 225 for saplings that are at an azimuth between 181 and 270, and 315 for saplings that are at an azimuth between 271 and 360.

3) Record a HORIZONTAL DISTANCE of 3.0 for all microplot saplings. Note: this may be pre-filled and hence may not need to be recorded.

4) Measure a few ACTUAL and TOTAL LENGTHs of saplings and code them accordingly. After a few measurements, estimate ACTUAL and TOTAL LENGTHs for the remaining saplings. Make sure to code the proper LENGTH METHOD.

5) Record all other required data items.

E. Seedling requirements

A seedling is: a live tree less than 1.0 in. d.b.h., a conifer at least 0.5 ft. in length or a hardwood at least 1.0 ft. in length. Select a seedling only if its bole center at the ground (or other substrate) is within 6.8 feet (horizontal distance) of microplot center.

General seedling count rules:

• Count all live seedlings with their bases inside the microplot boundary regardless of vigor, damage, or closeness to other trees.
• Count all live seedlings, regardless of substrate (e.g. suspended logs) or life expectancy.
• Multiple “suckers” that originate from the same location, and stump sprouts are considered one seedling.
• Measure seedling length, not “height”. Length is measured along the main stem from ground level to the dominant apical leader.
• Do not tally or count “layers” (undetached tree branches partially or completely covered by soil and/or organic materials, usually at the base) as seedlings.
• Do not tally any seedlings that sprout from a live tally tree.

F. Tree and snag selection MQO

Tally tree selection

Tolerance: Live tree ≥ 5.0 in. on the subplot: No errors
Dead tree ≥ 5.0 in. on the subplot: No errors
Sapling: No errors

10 TREE AND SAPLING DATA

Trees at least 5.0 inches in diameter are sampled within the subplot. 'Tally trees' are defined as all live and standing dead trees in accessible forest land condition classes (CONDITION CLASS STATUS = 1) and in accessible nonforest condition classes when nonforest is being sampled (NONFOREST SAMPLING STATUS = 1 and CONDITION CLASS STATUS = 2 and NONFOREST CONDITION CLASS STATUS = 2) encountered on the subplot the first time a subplot is established, and all trees that grow into a subplot thereafter. These data yield information on tree volume, growth, mortality, and removals; wildlife habitats; forest structure and composition; biomass; and carbon sequestration.

Trees with a diameter at least 1.0 inch but less than 5.0 inches, termed saplings, are sampled within the microplot. 'Tally saplings' are defined as all live saplings in accessible forest land condition classes encountered the first time a microplot is established, and all saplings that grow into each microplot thereafter are included until they grow to 5.0 inches or larger, at which time they are tallied on the subplot and referenced (new AZIMUTH and HORIZONTAL DISTANCE taken) to the subplot center.

Trees are alive if they have any living parts (leaves, buds, cambium) at or above the point of diameter measurement, either diameter at breast height (DBH) or diameter at root collar (DRC). Trees that have been temporarily defoliated are still alive.

Once tallied, dead trees over 5.0 inches in diameter are tracked until they no longer qualify as standing dead. **Working around dead trees is a safety hazard - crews should exercise extreme caution! Trees that are deemed unsafe to measure should be estimated.**

To qualify as a standing dead tally tree, dead trees must be at least 5.0 inches in diameter, have a bole which has an unbroken ACTUAL LENGTH of at least 4.5 feet, and lean less than 45 degrees from vertical as measured from the top of the root collar to 4.5 feet.

The portion of a bole on dead trees that are separated greater than 50 percent (either above or below 4.5 feet), are considered severed and may qualify as Down Woody Material (DWM). See DWM procedures (Phase 3 Supplement) for tally criteria.

For woodland species with multiple stems, a tree is considered down if more than 2/3 of the volume is no longer attached or upright; do not consider cut and removed volume. For woodland species with single stems to qualify as a standing dead tally tree, dead trees must be at least 5.0 inches in diameter, be at least 1.0 foot in unbroken ACTUAL LENGTH, and lean less than 45 degrees from vertical.

Live and dead standing tally trees, and partially separated boles of dead tally trees, do not have to be self-supported. They may be supported by other trees, branches, or their crown.

Trees that have been cut above DBH qualify as tally trees, provided they meet the size requirement.

The following apply at remeasurement:
If at the previous visit a forked tree was recorded as two separate trees but should have been recorded as one tree, give one of the tree data lines a PRESENT TREE STATUS = 0, RECONCILE = 7 or 8, and a TREE NOTE. The remaining tree data line receives PRESENT TREE STATUS = 1 or 2 with DIAMETER CHECK = 2, and a TREE NOTE.

If at the previous visit a forked tree was recorded as one tree but should have been recorded as two separate trees, correct the diameter for the remeasured tree to represent one tree, and add the other fork as a missed tree. Use the existing tree data line to represent one of the stems. PRESENT TREE STATUS = 1 or 2, DIAMETER CHECK = 2, and a TREE NOTE. The second stem would get PRESENT TREE STATUS = 1 or 2, RECONCILE 3 or 4, and a TREE NOTE.

Begin tallying trees at an azimuth of 001 degrees from subplot center and continue clockwise around the subplot. Repeat this sequence for trees on the microplot.

10.1 SUBPLOT NUMBER (CORE 5.1) [SUBP]

A 1-digit code, generated for each tree record entered into the PDR, regardless of the status of a tree (live tree, snag, witness-only tree, etc).

When Collected: All tree records
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values:

1	Center subplot
2	North subplot
3	Southeast subplot
4	Southwest subplot

10.2 TREE RECORD NUMBER (CORE 5.2) [TREE]

A 3-digit code, assigned by the PDR, to uniquely and permanently identify each tree on a given subplot. At the time of remeasurement (SAMPLE KIND = 2), TREE RECORD NUMBERS will be downloaded for previously recorded trees, snags, and witness-only records. TREE RECORD NUMBERS cannot be changed by the field crew.

When Collected: All tree records
Field width: 3 digits
Tolerance: No errors
MQO: At least 99% of the time
Values: 001 to 999

10.3 TREE TAG NUMBER (HAWAII/PFSL) [TAG_NO_PNWRS]

Affix an aluminum tree number tag and record a TREE TAG NUMBER for all tally trees >= 1.0 inch DBH/DRC (**except** witness-only trees) sampled at the current inventory; this includes trees recorded, but not tagged, during a precious visit (e.g., saplings and snags). Number trees in a clockwise order from AZIMUTH 001 to 360, and work outwards from subplot center to subplot perimeter. Repeat this sequence for saplings on the microplot. Attempt to keep tree numbers in order. However, **do not** renumber all trees on a microplot/subplot in order to assign more "correct" tree number to a missed tree.

Saplings <3.0 inches DBH/DRC: Wire the tag to an ancillary branch

Saplings >=3.0 inches DBH: Nail the tag below stump height and facing microplot center. ***Special Note:** Lands owned by the Division of Forestry and Wildlife (DOFAW) – Do not affix any tags or nails below 6.0 ft. Affix the tree number tag number to the upper dbh nail that will be located at 6.0 ft or higher.

Trees >= 5.0 inches DBH: Nail the tag below stump height and facing subplot center. ***Special Note:** Lands owned by the Division of Forestry and Wildlife (DOFAW) – Do not affix any tags or nails below 6.0 ft. Affix the tree number tag number to the upper dbh nail that will be located at 6.0 ft or higher.

- Live trees: Drive the nail in only as far as is necessary to firmly anchor it in the wood. If a tree which requires a TREE TAG NUMBER has a PNW-FIA tag, discard it. If an old tag cannot be removed, pound it in until flush with the bark so it will be overgrown and will not be confused with the new tag.
-
- Standing dead trees: Pound the nail flush with the bole on all standing dead trees; including previously live trees, which are now dead.

Do not use a TREE TAG NUMBER more than once on a plot. Before leaving the vehicle, make sure the tree numbers previously assigned to downloaded trees are different than numbers on the new tags you may use.

When Collected: WHEN PRESENT TREE STATUS = 1; or when PRESENT TREE STATUS = 2 and STANDING DEAD = 1
Field width: 3 digits
Tolerance: No errors
MQO: N/A
Values: 001 to 999

10.4 PREVIOUS TAG NUMBER (HAWAII/PFSL) [PREV_TAG_NO_PNWRS]

If any tree tallied at the current inventory has a tree number tag from the previous visit, record the tag number. This item is recorded for live trees, dead trees, and saplings, and will help link current data to previously collected data.

If more than one old tree number tag is present, record the one from the most recent inventory.

If more than one old tree number tag is present and **a tag is reused**, record the TREE TAG NUMBER from the previous visit for the "current" TREE TAG NUMBER and also for PREVIOUS TREE TAG NUMBER.

> When Collected: WHEN SAMPLE KIND = 2
> Field width: 3 digits
> Tolerance: No errors
> MQO: N/A
> Values: 001 to 999

10.5 CONDITION CLASS NUMBER (CORE 5.3) [CONDID]

Record the CONDITION CLASS NUMBER in which each tree is located. Often, a referenced boundary is approximate, and trees selected for tally are assigned to the actual condition in which they lie regardless of the recorded approximate boundary (Figure 24).

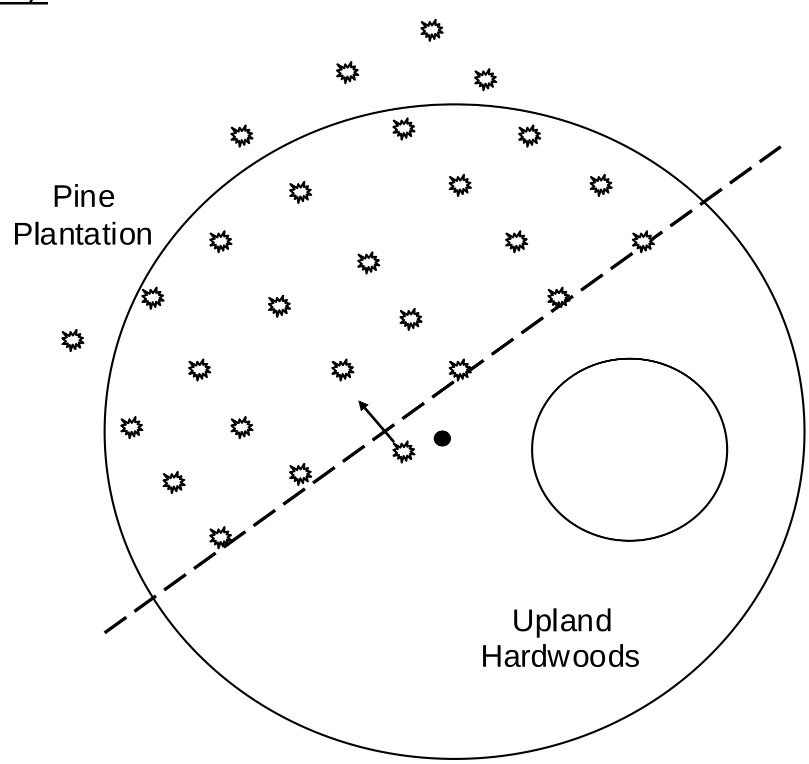


Figure 24. Ragged CONDITION CLASS boundary and tree condition class designation.

When Collected: All tally trees
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values: 1 to 9

10.6 PREVIOUS TREE STATUS (CORE 5.6) [PREV_STATUS_CD]

A downloaded code for all trees tallied at the previous inventory. This code is used to track the status of sample trees over time, correct even if the tree no longer qualifies as a tally tree. Add PREVIOUS TREE STATUS if null and tree was not tallied at the previous inventory because of a definition or procedural change (RECONCILE = 10).

When collected: When SAMPLE KIND = 2: all previously tallied trees >= 1.0 inch DBH. Update when null and RECONCILE = 10.

Field width: 1 digit
Tolerance: No errors
MQO: At least 95% of the time
Values:

1 Live Tree – alive at the previous inventory
2 Dead tree – standing dead tree at the previous inventory

10.7 PRESENT TREE STATUS (CORE 5.7) [STATUSCD_PNWRS; Regional codes 7, 8, 9 loaded in NON_TALLY_TREE_PNWRS]

Record a PRESENT TREE STATUS for each tallied tree; this code is used to track the status of sample trees over time: as they first appear, as ingrowth, as they survive, and when they die or are removed. Witness-only trees/stumps/objects are also assigned a PRESENT TREE STATUS.

When Collected: When SAMPLE KIND = 1: all new live tally trees >= 1.0 inches DBH; all new dead tally trees >= 5.0 inches DBH; and witness non-tally trees, witness stumps, and witness-only objects. When SAMPLE KIND = 2: all previously tallied trees.

Field width: 1 digit

Tolerance: No errors

MQO: At least 95% of the time

Values:

0 No Status - Remeasurement plots only. Tree is not presently in the sample. Tree was incorrectly tallied at the previous inventory, currently is not tallied due to definition or procedural change, or is not tallied due to natural causes. Requires RECONCILE code = 5-9.

1 Live tree – any live tally tree (new, remeasured or ingrowth)

2 Dead tree -- Any dead tree (new, remeasured or ingrowth) regardless of cause of death. Includes all previously standing dead trees that no longer qualify as standing dead, as well as trees killed by silvicultural or land clearing activity, and are assumed not to have been utilized. *Includes: previously dead standing, now down, and previously dead standing that no longer meet diameter and length requirements.*

3 Removed - Remeasurement plots only. A tree that has been cut or removed by direct human activity related to harvesting, silvicultural activity or land clearing. The tree is assumed to have been utilized.

7 Witness Stump – A subplot witness that is a stump

8 Witness Non-Tally Tree – A **non-tally** live or dead tree that is to be used for a subplot witness

9 Witness-Only Object – A subplot **witness that is not a tree.** It may be a shrub, rock, or other; TREE NOTES are required to describe the witness.

10.8 SUBPLOT TALLY TREE WITNESS (PNW) [SUBP_WITNESS_FLAG_PNWRS]

Use this data item to mark the current tally tree (live or dead) as a witness. See “Referencing the plot” on p.29, for witness monumentation instructions. Note: The default for this item is “N”; **update then field to “Y” to record a witness.**

When collected: When PRESENT TREE STATUS = 1; or when PRESENT TREE STATUS = 2 and STANDING DEAD = 1

Field width: 1 digit
Tolerance: No errors
MQO:
Values:

Y – current record is a tally tree witness
N – current record is not a tally tree witness

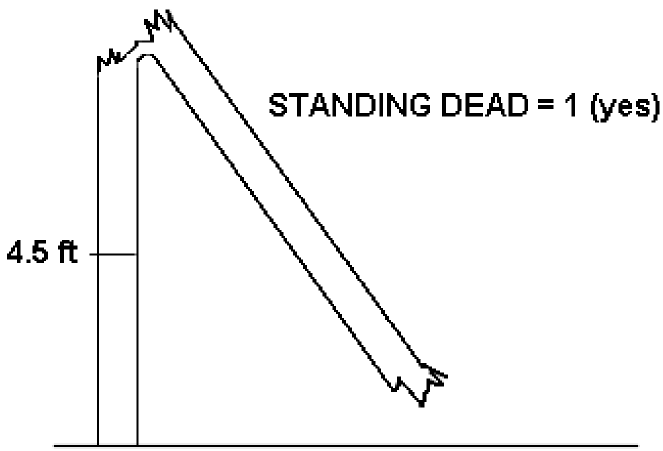
10.9 STANDING DEAD (CORE 5.7.2) [STANDING_DEAD_CD]

Record the code that describes whether or not a tree qualifies as standing dead. To qualify as a standing dead tally tree, dead trees must be at least 5.0 inches in diameter, have a bole which has an unbroken ACTUAL LENGTH of at least 4.5 feet, and lean less than 45 degrees from vertical as measured from the top of the root collar to 4.5 feet. See figures below for examples.

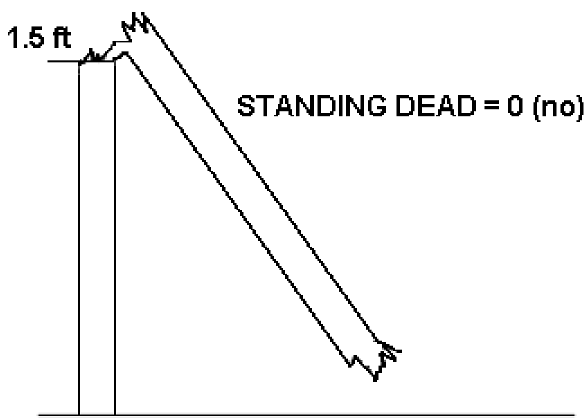
“Unbroken” is defined as at least 50 percent attached to the original source of growth. The degree of lean on dead trees with partially separated (i.e., 1 to 50 percent) boles is measured from the top of the root collar to the top of ACTUAL LENGTH.

Portions of boles on dead trees that are separated greater than 50 percent (either above or below 4.5 feet), are considered severed and are included in Down Woody Material (DWM) if they otherwise meet DWM tally criteria.

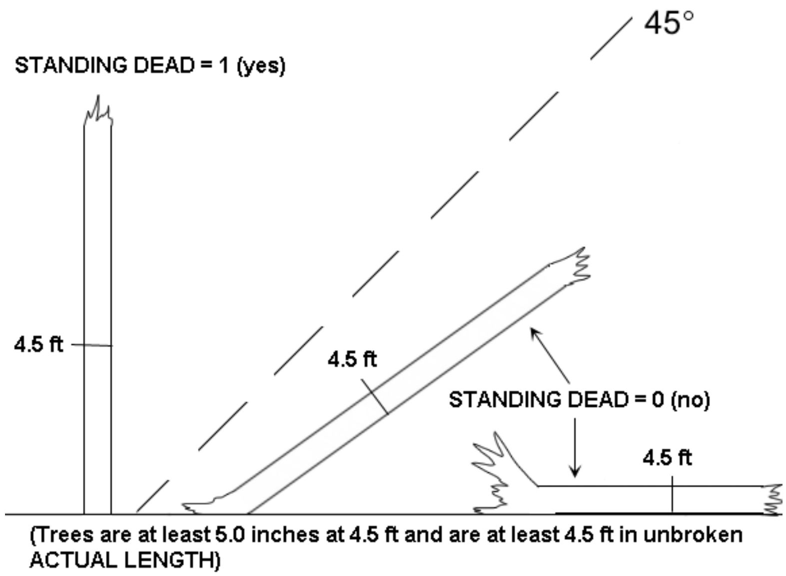
Live and dead standing tally trees, and partially separated boles of dead tally trees, do not have to be self-supported. They may be supported by other trees, branches, or their crown.



(Tree is at least 5.0 inches at 4.5 ft and is at least 4.5 ft in unbroken ACTUAL LENGTH)



(Tree is at least 5.0 inches at 4.5 ft, but does not have 4.5 ft in unbroken ACTUAL LENGTH)



When collected: All dead tally trees (PRESENT TREE STATUS = 2)
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values:

0	No – tree does not qualify as standing dead.
1	Yes – tree does qualify as standing dead.

10.10 LEAN ANGLE CODE (HAWAII) [LEANCD]

Record the code that describes the angle of lean from vertical of the tree, from top of root collar to top of **ACTUAL LENGTH (Note: not 4.5 ft like STANDING DEAD).** Trees supported by other trees or by their own branches are considered standing.

When Collected: All live and standing dead tally trees $\geq$ 5.0 in DBH
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values:

0	Standing (less than 45 degrees of lean from vertical)
1	Down (more than 45 degrees of lean)

10.11 RECONCILE (CORE 5.7.1) [RECONCILEDCD_PNWRS]

<u>For remeasurement locations only, record a RECONCILE code for any new tally tree that was not tallied in the previous inventory, and for all no status remeasurement trees (PRESENT TREE STATUS = 0). This code is used to identify the reason a new tree appeared in the inventory, and identify the reason a remeasurement tree no longer qualifies as a tally tree. This information is needed to correctly assign volume information to the proper component of volume change.</u>

Code 5 is used to indicate live trees that shrink below the diameter threshold on the microplot/subplot. For example, if a live remeasurement tree shrinks below the 5.0 inch DBH/DRC, then record the following combination of codes: PREVIOUS TREE STATUS = 1, PRESENT TREE STATUS = 0, RECONCILE = 5. If a live measured tree shrinks below the 5.0 inch threshold on the subplot and is currently greater than or equal to 1.0 inch on the microplot, then record PREVIOUS TREE STATUS = 1, PRESENT TREE STATUS = 1. Record all required items for a tally sapling.

When Collected: On SAMPLE KIND = 2; all new live tally trees ≥ 1.0 in DBH (PRESENT TREE STATUS = 1 and no PREVIOUS TREE STATUS), all new dead tally trees ≥ 5.0 in (PRESENT TREE STATUS = 2 and no PREVIOUS TREE STATUS), all no status trees (PRESENT TREE STATUS = 0)

Field width: 2 digits
Tolerance: No errors
MQO: At least 95% of the time
Values:

Codes 1-4 & 10 are valid for new trees on the plot:

1	Ingrowth – either a new tally tree not qualifying as through growth or a new tree on land that was formerly nonforest and now qualifies as forest land (reversion or encroachment).
2	Through growth – new tally tree 5.0 inches DBH/DRC and larger, within the microplot, which was not missed at the previous inventory.
3	Missed live – a live tree missed at previous inventory and that is live or dead now.
4	Missed dead – a dead tree missed at previous inventory that is dead now.
10	Procedural change – a tree not tallied at the previous inventory, but is included in the tree tally now because of a definition or procedural change.

Codes 5-9 are valid for remeasured trees that no longer qualify as tally:

5	Shrank – live tree that shrank below threshold diameter on microplot/subplot.
6	Missing (moved) – tree was correctly tallied in previous inventory, but has now moved beyond the radius of the plot due to natural causes (i.e., small earth movement, hurricane). Tree must be either live before and still alive now or dead before and dead now. If tree was live before and now dead, this is a mortality tree and should have PRESENT TREE STATUS = 2 (not 0).
7	Cruiser error – erroneously tallied at previous inventory.
8	Procedural change – tree was tallied at the previous inventory, but is no longer tallied due to a definition or procedural change.

9	Tree was sampled before, but now the area where the tree was located is nonsampled. All trees on the nonsampled area have RECONCILE = 9.

10.12 SPECIES (CORE 5.8) [SPCD; PREV_SPCD_PNWRS]

Record the appropriate SPECIES code from the list beginning in Appendix 1, page 199. If a species is encountered that is not listed in Appendix 1 and it is not clear if it should be tallied as a tree, consult the Field Supervisor. If the species cannot be determined in the field, tally the tree, but bring branch samples, foliage, cones, flowers, bark, etc. to the supervisor for identification. If possible, collect samples outside the subplots from similar specimens and make a note to correct the SPECIES code later. Use code 0299 for unknown dead conifer, 0998 for unknown dead hardwood when the genus or species codes cannot be used, and 0999 for other or unknown live tree. The generic code should only be used when you are sure the species is on the species list, but you cannot differentiate among acceptable species. This is often the case with standing dead trees on newly established plots. In this case use the sample collections procedures described earlier in this paragraph.

When Collected: All trees (PRESENT TREE STATUS = 0-8)
Field width: 4 digits
Tolerance: No errors
MQO: At least 99% of the time for genus, at least 95% of the time for species
Values: See Appendix 1 (Tree Species List, page 199)

10.13 AZIMUTH (CORE 5.4) [AZIMUTH; PREV_AZM_PNWRS]

For microplots with excessive saplings (20 or more) see "*Microplots with excessive saplings*" on page 134 for special coding instructions to help speed up the measurement of microplots.

Record the AZIMUTH from the subplot center (for trees greater than or equal to 5.0 inches DBH/DRC) or the microplot center (for trees greater than or equal to 1.0 inch and less than 5.0 inches DBH/DRC), sight the center of the bole where the pith intersects the ground with a compass. Sight to the geographic center for multi-stemmed woodland species. The geographic center is a point of equal distance between all tallied stems for a given woodland tree. Record AZIMUTH to the nearest degree. Use 360 for north.

When Collected: All live tally trees > 1.0 in DBH and standing dead tally trees > 5.0 in DBH, and witness-only trees/stumps/objects. When SAMPLE KIND = 2, downloaded previous AZIMUTH must be verified.

Field width: 3 digits
Tolerance: Tally trees:+/- 10 degrees; Witness only trees/stumps/objects: =/- 4 degrees
MQO: At least 90% of the time
Values: 001 to 360; 45, 135, 225, or 315 only when HIGH TALLY SAPLING PROCEDURES = 1

10.14 HORIZONTAL DISTANCE (CORE 5.5) [DIST PREV_HORIZ_DIST_PNWRS]

For microplots with excessive saplings (20 or more) see "*Microplots with excessive saplings*" on page 134 for special coding instructions to help speed up the measurement of microplots.

<u>Record the measured HORIZONTAL DISTANCE, to the nearest 0.1 foot, from the subplot center (for trees greater than or equal to 5.0 inches DBH) or microplot center (for trees greater than or equal to 1.0 inch and less than 5.0 inches DBH) to the pith of the tree at the base.</u>

> When Collected: All live tally trees > 1.0 in DBH and standing dead tally trees > 5.0 in DBH. When SAMPLE KIND = 2, downloaded previous DISTANCE must be verified.
>
> Field width: 3 digits (xx.y)
> Tolerance: Microplot: +/- 0.2 ft
> Subplot: +/- 1.0 ft
> MQO: At least 90% of the time
> Values: Microplot: 00.1 to 6.8;
> 3.0 only when HIGH TALLY SAPLING PROCEDURES = 1
> Subplot: 00.1 to 24.0

10.15 SLOPE DISTANCE TO WITNESS TREE OR OBJECT (PNW) [SLOPE_DIST_TO_WITNESS_PNWRS]

Record the SLOPE DISTANCE, to the nearest 0.1 foot, from the base of the subplot center pin, to the head of the nail that affixes the basal tag or other witness object. If more than one nail is used to affix the basal tag, measure to the head of the top nail. If a basal tag cannot be attached to the witness tree/object, or if in national parks or lands owned by the Department of Fish and Wildlife (DOFAW, see "Recording witness tree data" found on page 30) where basal tags cannot be used, measure from the base of the subplot to the front of the tree/object at the base.

On remeasurement plots (SAMPLE KIND = 2), previous SLOPE DISTANCE will be downloaded into the current SLOPE DISTANCE field. The current crew is responsible for verifying downloaded data and updating when it is out of tolerance.

> When Collected: All witness trees, stumps, or objects (PRESENT TREE STATUS = 1 or 2 and SUBPLOT TALLY TREE WITNESS FLAG = Y; or PRESENT TREE STATUS = 7, 8, or 9). When SAMPLE KIND = 2: previous SLOPE DISTANCE must be verified.
>
> Field width: 3 digits (xx.y)
> Tolerance: +/- 0.2 ft
> MQO: At least 90% of the time
> Values: 00.1 to 99.9

10.16 DIAMETER

***Special Note: For plots found on Lands owned by the Division of Forestry and Wildlife (DOFAW)** there should be no nails in trees below 6.0 feet. Use the following procedures:

A) For trees where dbh is taken between 4.5 feet and 5.9 feet: pound the nail with number tag attached into the tree 1.5 feet above the measurement point (Be exact – as the remeasurement crew will take their measurements 1.5 feet below the nail). Record the DIAMETER and LENGTH TO DIAMETER MEASURMENT POINT at the point of measurement (not the nail).

B) For trees where dbh is taken at 6.0 feet or higher: pound the nail with number tag attached into the tree at the diameter measurement point. Record the DIAMETER and LENGTH TO DIAMETER MEASUREMENT POINT at the nail.

C) For trees where dbh needs to be estimated: pound the nail with number tag attached into the tree at 6.0 feet. Record the estimated DIAMETER at 4.5ft and record "4.5" for LENGTH TO DIAMETER MEASUREMENT POINT. Make sure to code the appropriate DIAMETER CHECK code.

The following are normal procedures that are to be followed with the exception of the addendums written above for lands owned by the Division of Forestry and Wildlife (DOFAW):

<u>Diameters are measured at breast height (DBH). Trees with diameters between 1.0- and 4.9-inches are measured on the 6.8-foot radius microplot, those with diameters of 5.0-inches and larger are measured on the 24-foot radius subplots.</u>

<u>In order to accurately remeasure diameter at the same point on the tree bole at successive visits, mark the point of measurement with an aluminum nail. When marking trees for the first time, measure the diameter after the nail is in place. Use caution to avoid damaging trees with nails. Do not nail trees less than 3.0-inches in diameter, or species vulnerable to introduction of pathogens (e.g., aspen).</u>

If the diameter cannot be physically measured for any reason, estimate the diameter using a Relaskop or electronic equivalent. These procedures are described in Appendices 7 and 8, pages 265-268.

Remeasurement Trees:

<u>When remeasuring the diameter of a tree tallied at a previous survey, always take the measurement at the location monumented by the previous crew unless it is not physically possible (e.g., tree buried by mudslide), there is an abnormality at the previous DIAMETER measurement point, or the previous location is more than 12 inches beyond where the diameter should be measured according to current protocols (either because protocols have changed or the previous crew made a</u>

mistake). Assign a DIAMETER CHECK code of 2 whenever the point of measurement is moved.

10.16.1 PREVIOUS DIAMETER AT BREAST HEIGHT (CORE 5.9.1) [PREVDIA]

This is the DBH assigned at the previous survey. It has been downloaded from the previous inventory. Any change made to this field signifies an error at the time of the previous inventory. DIAMETER CHECK should be set to 2 and an explanation is required in the notes if previous DBH is changed.

When Collected: Downloaded when SAMPLE KIND = 2: all previous tallied trees>= 1.0 inch DBH
Field width: 4 digits (xxx.y)
Tolerance: N/A
MQO: At least 95% of the time
Values: 001.0 to 999.9

10.16.2 DIAMETER AT BREAST HEIGHT (CORE 5.9.2) [DIA]

Unless one of the special situations described below is encountered, measure DBH at 4.5 ft above the ground line on the uphill side of the tree. Round each measurement down to the last 0.1 inch. For example, a reading of 3.68 inches is recorded as 3.6 inches. *Note: Although stumps do no meet DBH criteria, their DIAMETERS are recorded in this data item.

When Collected: All live tally trees > 1.0 in DBH and standing dead tally trees > 5.0 in DBH, witness-only trees (PRESENT TREE STATUS = 1,2, or 8); and witness stumps* (PRESENT TREE STATUS = 7)

Field width: 4 digits (xxx.y)
Tolerance: +/- 0.1 in per 20.0 in increment of measured diameter on all live trees and dead trees with DECAY CLASS = 1, 2; +/- 1.0 in per 20.0 in increment of measured diameter on dead trees with DECAY CLASS = 3, 4, 5

MQO: At least 95% of the time
Values: 001.0 to 999.9

Special DBH situations:

1. **Forked tree:** In order to qualify as a fork, the stem in question must be at least 1/3 the diameter of the main stem and must branch out from the main stem at an angle of 45 degrees or less. Forks originate at the point on the bole where the piths intersect. Forked trees are handled differently depending on whether the fork originates below 1.0 ft, between 1.0 and 4.5 ft, or above 4.5 ft.

    - **Trees forked below 1.0 ft.** Trees forked in this region are treated as distinctly separate trees (Figure 25). Distances and azimuths are measured individually to the

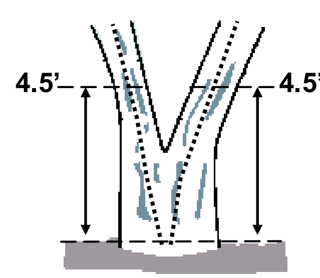


Figure 25. Forked below 1.0 ft.

center of each stem where it splits from the stump (Figure 28 A-C). DBH is measured for each stem at 4.5 ft above the ground. When stems originate from pith intersections below 1 ft, it is possible for some stems to be within the limiting distance of the microplot or subplot, and others to be beyond the limiting distance. If stems originating from forks that occur below 1.0 ft fork again between 1.0 and 4.5 ft (Figure 28-B), the rules in the next paragraph apply.

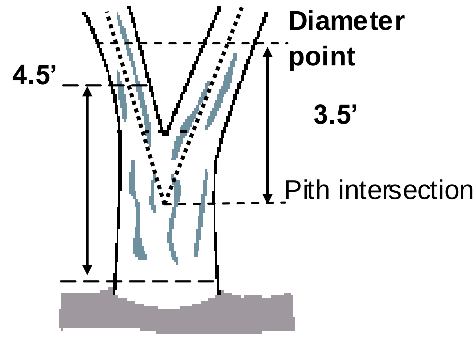


Figure 26. Forked between 1.0-4.5 ft.

- **Trees forked between 1.0 ft and 4.5 ft.** Trees forked between 1.0 foot and 4.5 feet are also counted as separate trees (Figure 26), but only one distance and azimuth (to the central stump) is recorded for each stem (Figure 28 D-F). Although a single azimuth and distance applies to all, multiple stems should be recorded as they occur in clockwise order (from front to back when one stem is directly in front of another). The DBH of each fork is measured at a point 3.5 ft above the pith intersection. When forks originate from pith intersections between 1.0 and 4.5 ft, the limiting distance is the same for all forks--they are either all on, or all off the plot.

  Multiple forks are possible if they all originate from approximately the same point on the main stem. In such cases, measure DBH on all stems at 3.5 ft above the common pith intersection (Figure 28 F).

  Once a stem is tallied as a fork that originated from a pith intersection between 1.0 and 4.5 ft, do not recognize any additional forks that may occur on that stem. Measure the diameter of such stems at the base of the second fork as shown in Figure 28-E (i.e., do not move the point of diameter the entire 3.5 ft above the first fork).

- **Trees forked at or above 4.5 ft.** Trees forked in this at or above 4.5 feet count as one single tree (Figure 27). If a fork occurs at or immediately above 4.5 ft, measure diameter below the fork just beneath any swelling that would inflate DBH.

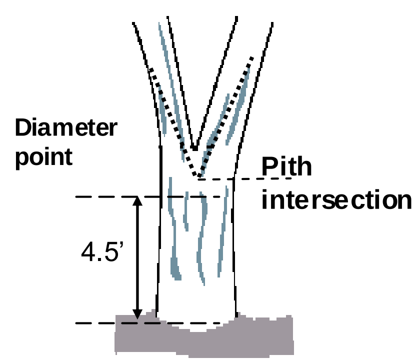


Figure 27. Tree forked above 4.5 ft

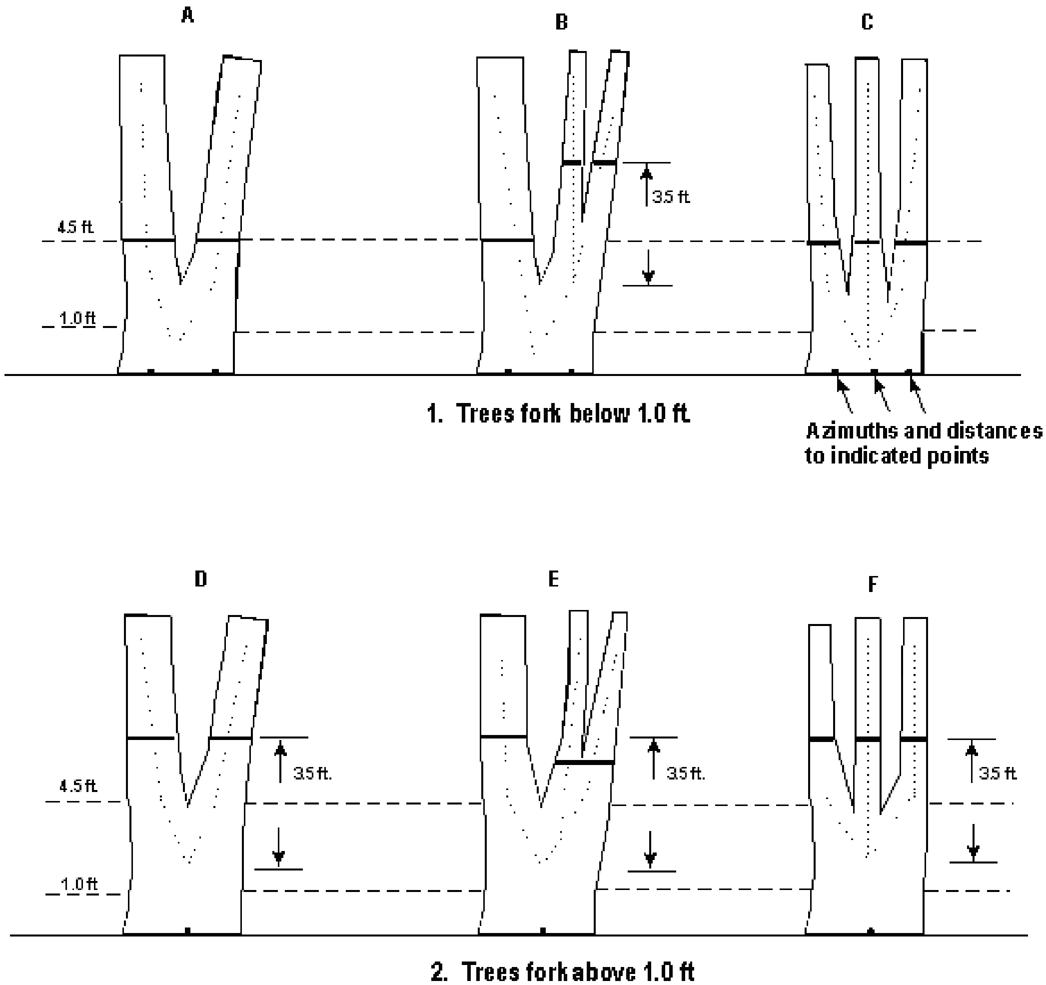


Figure 28. Summary of where to measure DBH, distance, and azimuth on forked trees.

2. **Stump Sprouts.** Stump sprouts originate between ground level and 4.5 ft on the boles of trees that have died or been cut. Stump sprouts are handled the same as forked trees, with the exception that stump sprouts are not required to be 1/3 the diameter of the dead bole. Stump sprouts originating below 1.0 ft are measured at 4.5 ft from ground line. Stump sprouts originating between 1.0 ft and 4.5 ft are measured at 3.5 ft above their point of occurrence. As with forks, rules for measuring distance and azimuth depend on whether the sprouts originate above or below 1.0 ft.

3. **Tree with butt-swell or bottleneck**: Measure these trees 1.5 ft above the end of the swell or bottleneck if the swell or bottleneck extends 3.0 ft or more above the ground (Figure 29).

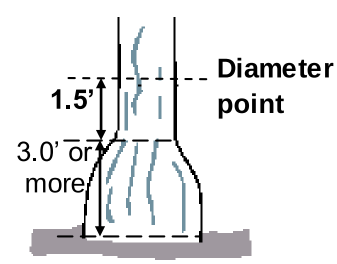


Figure 29. Bottleneck tree.

4. **Tree with irregularities at DBH**: On trees with swellings (Figure 30), bumps, depressions, and branches (Figure 31) at DBH, diameter will be measured immediately above the irregularity at the place it ceases to affect normal stem form.

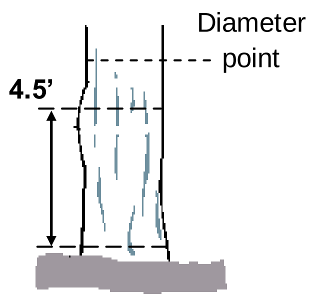


Figure 30. Tree with swelling.

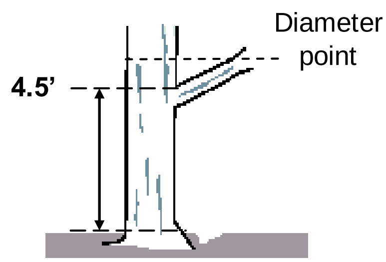


Figure 31. Tree with branch.

5. **Tree on slope**: Measure diameter at 4.5 feet from the ground along the bole on the uphill side of the tree (Figure 32).

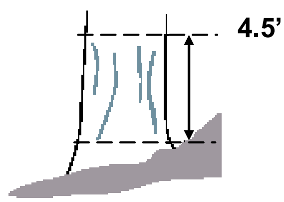


Figure 32. Tree on a slope.

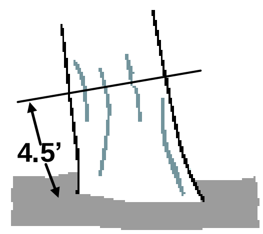


Figure 33. Leaning tree.

6. **Leaning tree**: Measure diameter at 4.5 ft from the ground along the bole. The 4.5 foot distance is measured along the underside face of the bole (Figure 33).

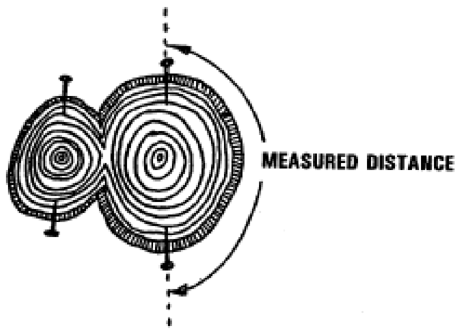
7. **Turpentine tree**: On trees with turpentine face extending above 4.5 feet, estimate the diameter at 10.0 feet above the ground and multiply by 1.1 to estimate DBH outside bark.

8. **Independent trees that grow together**: If two or more independent stems have grown together at or above the point of DBH, continue to treat them as separate trees. Set two diameter nails at DBH halfway around the tree's circumference from each other (after placing 1st nail, stand back from bole; take azimuth to nail; on opposite side of bole, place nail where the back azimuth of the first nail lines up). Measure the distance between the nails with a diameter tape. Multiply the

measurement by 2 and record the result as the current diameter. Example: Distance measured = 12.8 inches (12.8 X 2) = 25.6 inches. Set the DIAMETER CHECK code to “7”. See the figure 34 for a visual.

If unable to use the “Double Nail Method” estimate the diameter of each, set the “DIAMETER CHECK” code t “1“, and explain the situation in TREE NOTES.

Figure 34
Double-nail



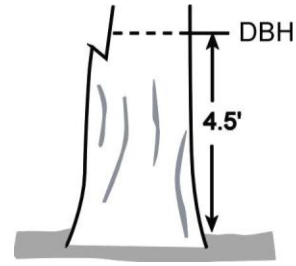


Figure 35. Tree with broken stem.

9. **Missing wood or bark**. Do not reconstruct the DBH of a tree that is missing wood or bark or at the point of measurement. Record the diameter, to the nearest 0.1, of the wood and bark that is still attached to the tree (Figure 35). If a tree has a localized abnormality (gouge, depression, etc.) at the point of point of DBH, apply the procedure described for trees with irregularities at DBH (Figure 30).

10. **Live windthrown tree**: Measure from the top of the root collar along the length to 4.5 feet (Figure 36).

Root Collar

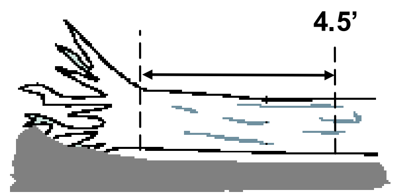


Figure 36. Tree on the ground.

11. **Down live tree with tree-form branches growing vertical from main bole**. When a down live tree, touching the ground, has vertical (<45° from vertical) tree-like branches coming off the main bole, first determine whether or not the pith of the main bole (averaged along the first log of the tree) is above or below the duff layer.

- If the pith of the main bole is above the duff layer, use the same forking rules specified for a forked tree, and take all measurements accordingly (Figure 37).

    - If the pith intersection of the main down bole and vertical tree-like branch occurs below 4.5 feet from the stump along the main bole, treat that branch as a separate tree, and measure DBH

3.5 feet above the pith intersection for both the main bole and the tree-like branch.

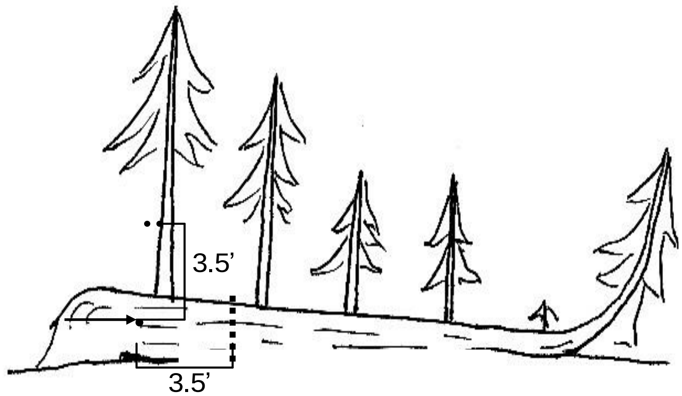


Figure 37. Down tree above duff. Use forking rules.

- o If the intersection between the main down bole and the tree-like branch occurs beyond the 4.5 feet point from the stump along the main bole, treat that branch as part of the main down bole.

- If the pith of main tree bole is below the duff layer, ignore the main bole, and treat each tree-like branch as a separate tree; take DBH and length measurements from the ground, not necessarily from the top of the down bole (Figure 38). However, if the top of the main tree bole curves out of the ground towards a vertical angle, treat that portion of that top as an individual tree originating where the pith leaves the duff layer.

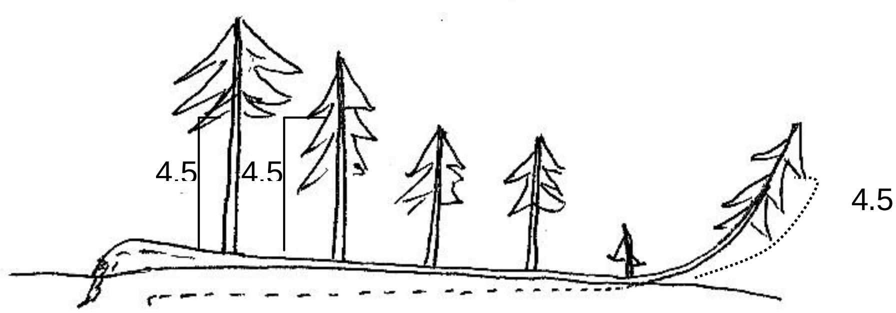


Figure 38. Down tree below duff. Treat each branch as a separate tree.

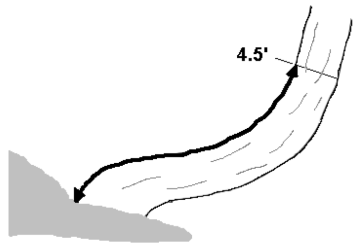


Figure 39. Tree with curved bole (pistol butt tree)

12. **Tree with curved bole (pistol butt tree)**. Measure along the bole on the uphill side (upper surface) of the tree (fig. 39).
13. **For trees with prop roots (e.g. Pandanas)**. Measure the diameter at 3.5 feet above the top of the prop root.

10.16.3 DIAMETER CHECK (CORE 5.12) [DIACHECK_PNWRS]

Record this code to identify any irregularities in diameter measurement positions (e.g., abnormal swellings, diseases, damage, new measurement positions, etc.) that may affect use of this tree in diameter growth/change analyses.

When Collected: All live tally trees ≥ 1.0 in DBH and standing dead tally trees ≥ 5.0 in DBH
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values:

0	Diameter measured accurately.
1	Diameter estimated, for any reason other than moss, vines, or the double nail method.
2	Diameter measured at different location than previous measurement (remeasurement trees only).
5	Diameter estimated because of moss
6	Diameter estimated because of vines
7	Diameter estimated (double nail diameter)

10.16.4 LENGTH TO DIAMETER MEASUREMENT POINT (CORE 5.24) [HTDMP]

This item will be autopopulated with 4.5 as most diameters will be taken at 4.5 feet. For those trees measured directly at 4.5 feet from the top of the root collar, leave this autopopulated number. If the diameter is not measured at 4.5 ft, update the actual length from the ground, to the nearest 0.1 inch, at which the diameter was measured for each tally tree, 1.0 in DBH and larger.

When Collected: All live and dead tally trees > 1.0 in DBH
Field width: 4 digits
Tolerance: +/- 0.2 ft
MQO: At least 90% of the time
Values: 00.1 – 30.0 (autopopulated with 4.5 - **updatable**)

10.16.5 LENGTH TO CENTROID DIAMETER (HAWAII) [CENTROID_DIA_HT_PNWRS]

The length from the top of the root collar to the point where a second stem diameter is measured, which is the point at 30% of the TOTAL LENGTH of the stem (rounded to the nearest 0.5 foot up to 19 feet TOTAL LENGTH, and to the nearest 1.0 foot if greater than or equal to 20 feet TOTAL LENGTH). This field is calculated by the data recorder after TOTAL LENGTH is entered and cannot be updated.
Exceptions: For tree ferns (SPCD = 6545, 6546, 6547, 6548, 6549), this field is blank.

When Collected: All live and standing dead tally trees >= 5.0 in DBH, except SPCD = 6545, 6546, 6547, 6548, and 6549
Field width: 4 digits (xxx.y)
Tolerance: N/A
Values: 001.0 to 999.0 (autopopulated – not updatable)

10.16.6 ACTUAL LENGTH TO CENTROID DIAMETER (HAWAII) [ACTUAL_CENTROID_DIA_HT_PNWRS]

The length from the top of the root collar to the point where a second stem diameter is actually measured; usually equal to 30% of the TOTAL LENGTH of the tree stem. This field is calculated by the data recorder after TOTAL LENGTH is entered *but can be updated* if abnormalities in the stem prevent a normal diameter measurement. Update ACTUAL LENGTH TO CENTROID DIAMETER if diameter is measured at different height. On trees with diameter irregularities (swellings, bumps, depressions, and branches), measure immediately above or below the irregularity at the place it ceases to affect normal stem form.

Do not adjust the ACTUAL LENGTH TO CENTROID DIAMETER by more than the following amount:

LENGTH TO CENTROID DIAMETER	
Up to 6 ft	+/- 1/2 foot
7 to 12 ft	+/- 1 foot
13 to 18 ft	+/- 2 feet
19 to 24 ft	+/- 3 feet
25 to 30 ft	+/- 4 feet
More than 30 ft	+/- 5 feet

Exception: For tree ferns (SPCD = 6546, 6547, 6545, 6548, 6549), measure the height to where the fronds emerge from the trunk.

When Collected: All live and standing dead tally trees >= 5.0 in DBH
Field width: 4 digits (xxx.y)

:

Tolerance	LENGTH TO CENTROID DIAMETER
+/- 1/2 foot	Up to 6 ft
+/- 1 foot	7 to 12 ft
+/- 2 feet	13 to 18 ft
+/- 3 feet	19 to 24 ft
+/- 4 feet	25 to 30 ft
+/- 5 feet	More than 30 ft

Values: 001.0 to 999.0 (autopopulated – updatable)

10.16.7 CENTROID DIAMETER ON UPPER BOLE (HAWAII) [CENTROID_DIA_PNWRS]

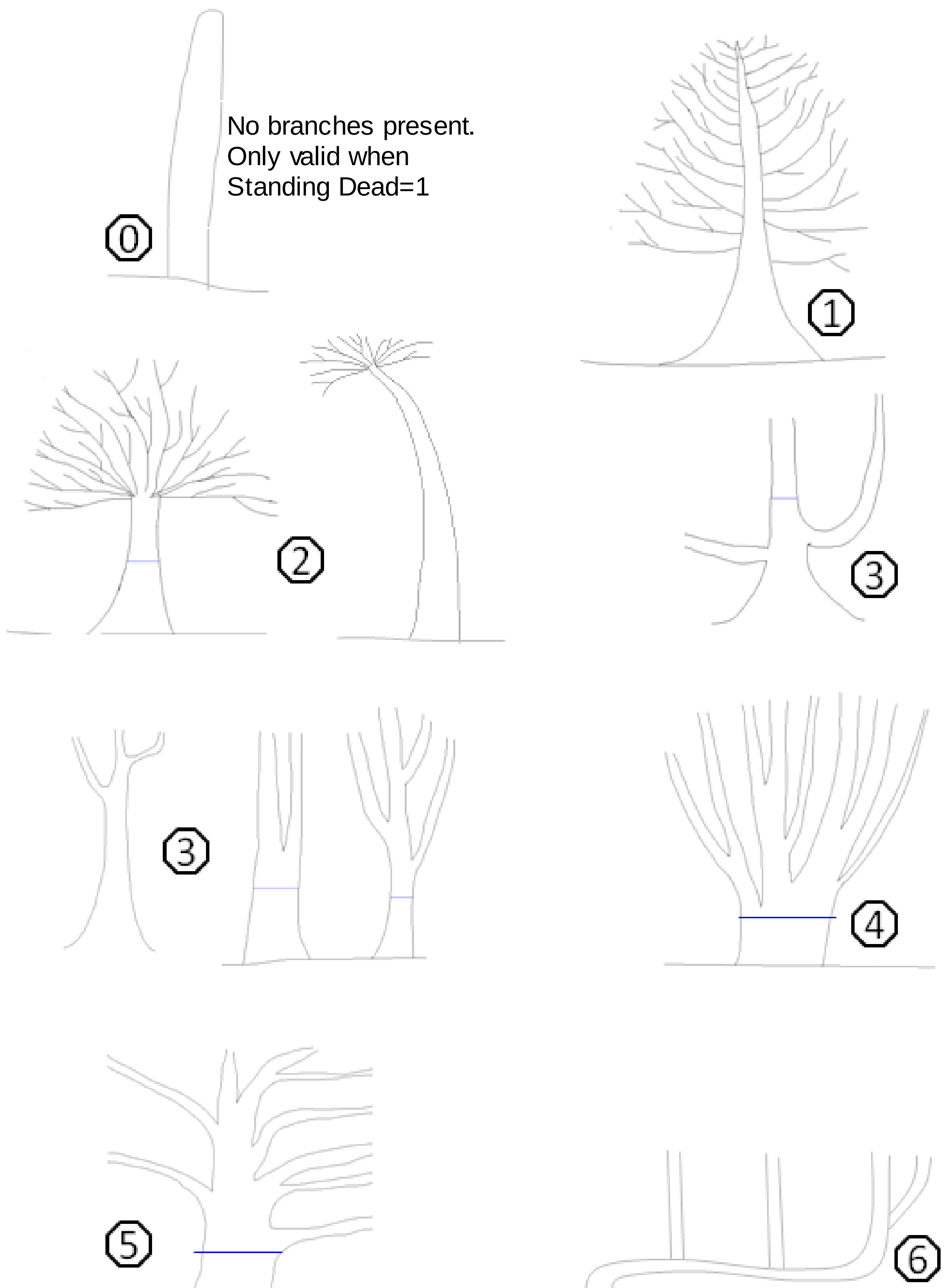
Measure and record the diameter at the ACTUAL LENGTH TO CENTROID location. For trees with a TOTAL LENGTH of up to 19 ft, record to the nearest 0.1 of an inch. For trees with a TOTAL LENGTH of 20 ft or more, record to the nearest 0.5 of an inch. Exception: For tree ferns (SPCD = 6546, 6547, 6545, 6548, 6549), measure the diameter where the fronds emerge from the trunk.

When Collected: All live and standing dead tally trees >= 5.0 in DBH
Field width: 4 digits (xxx.y)
Tolerance: +/- 0.1 inches for trees with up to 6 ft LENGTH TO CENTROID DIAMETER
+/- 1 inches for trees with 7 ft LENGTH TO CENTROID DIAMETER or more
Values: 001.0 to 999.9

10.17 BRANCHING CHARACTERISTICS (HAWAII) [BRANCH_FORM_PNWRS]

Record the branching form figure number that best represents the density and structure of the branching system.

When Collected: All live and standing dead tally trees >= 5.0 in d.b.h.
Field width: 1 digit
Tolerance: No errors
Values: 0-6 (as shown)



10.18 ROOT MEASUREMENTS FOR TROPICAL TREES

Tropical trees can exhibit prop (or stilted roots), buttressed roots, and various forms of aerial rooting systems. To accurately account for the often significant biomass associated with these special root systems, please measure and note the following.

10.18.1 TYPE OF ROOTING SYSTEM (HAWAII) [ROOT_SYSTEM_PNWRS]

Record the type of rooting system of tally trees and snags.

When Collected: All live and standing dead tally trees >= 5.0 in d.b.h.
Field width: 1 digit
Tolerance: No errors
Values:

0 = Normal roots (Default)
No other root measurements are needed

1 = Prop (Stilted) roots
Record **root diameters**, **rooting height**, and **density code**

2 = Buttressed roots
Record **number of buttresses** and **rooting height**

10.18.2 ROOT DIAMTER 1 (HAWAII) [STILT_ROOT_DIA1_PNWRS]

Record the largest diameter (to the nearest foot) of the entire prop root system at ground level.

When Collected: All live and standing dead tally trees >= 5.0 in d.b.h. with ROOTING SYSTEM = 1
Field width: 2 digits
Tolerance: +/- 10%
Values: 01 to 99 ft

10.18.3 ROOT DIAMETER 2 (HAWAII) [STILT_ROOT_DIA2_PNWRS]

Record the diameter of the prop root system perpendicular to the largest diameter recorded above, also at ground level and to the nearest foot.

When Collected: All live and standing dead tally trees >= 5.0 in d.b.h. with ROOTING SYSTEM = 1
Field width: 2 digits
Tolerance: +/- 10%
Values: 01 to 99 ft

10.18.4 ROOTING HEIGHT (HAWAII) [ROOT_HT_PNWRS]

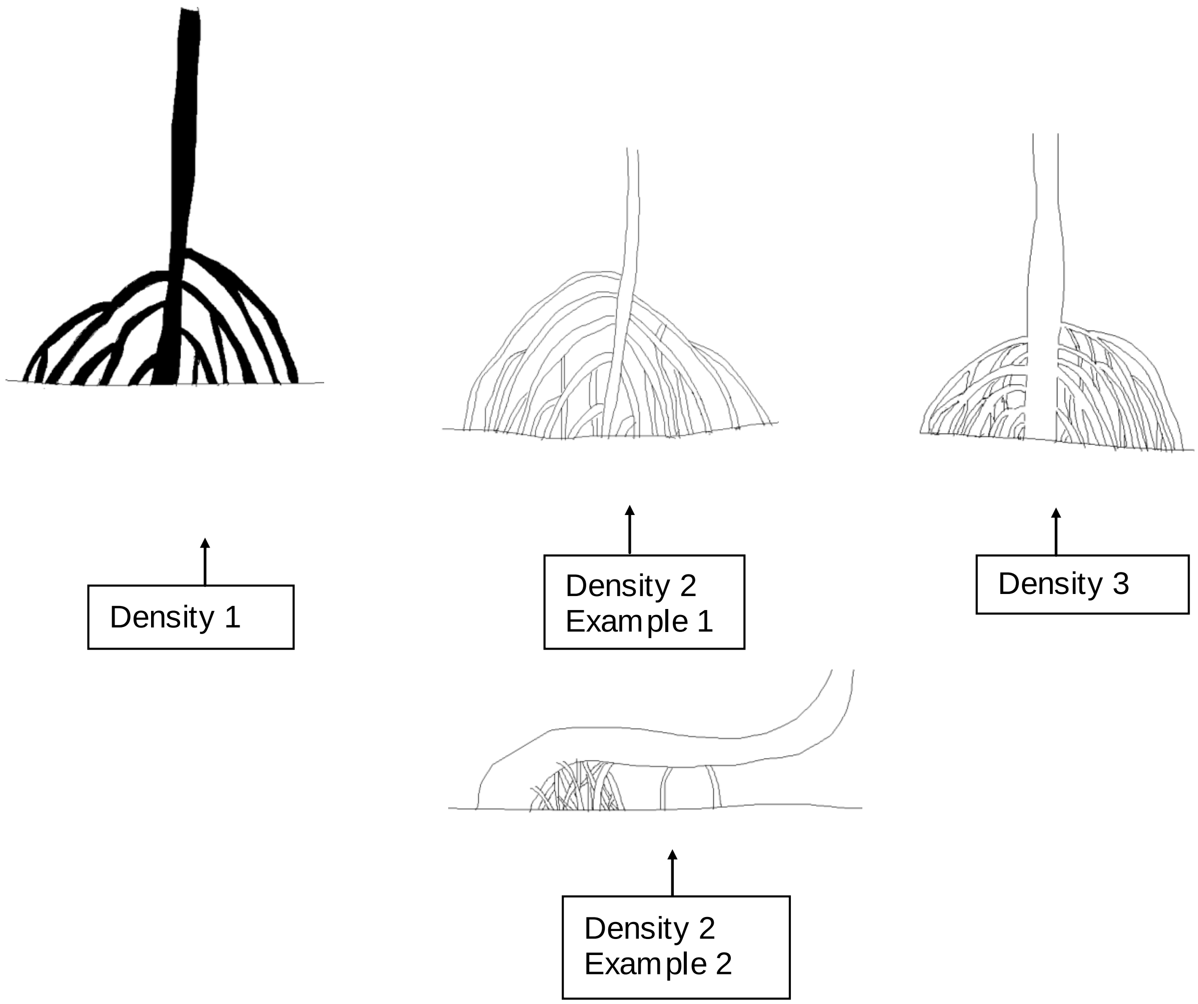
Record the height of the stilted or buttressed root system to the nearest foot, from ground level to the highest point where the stilts or buttresses protrude from the bole of the tree.

When Collected: All live and standing dead tally trees >= 5.0 in d.b.h with ROOTING SYSTEM = 1 or 2
Field width: 2 digits
Tolerance: +/- 10%
Values: 01 to 99 ft

10.18.5 PROP ROOT DENSITY (HAWAII) [STILT_DENSITY_PNWRS]

For prop roots, record the stilted roots figure number that best represents the density and structure of the stilted root system.

> When Collected: All live and standing dead tally trees >= 5.0 in d.b.h. with ROOTING SYSTEM = 1
> Field width: 2 digits
> Tolerance: No errors
> Values: 1-3 (as shown)



10.18.6 NUMBER OF BUTTRESSES (HAWAII) [NO_BUTTRESSES_PNWRS]

For buttressed roots, record the number of buttresses.

> When Collected: All live and standing dead tally trees >= 5.0 in d.b.h. with ROOTING SYSTEM = 2
> Field width: 2 digits
> Tolerance: +/- 2
> Values: 01 to 99.

10.18.7 AERIAL ROOT DENSITY (HAWAII) [AERIAL_ROOTS_PNWRS]

If there are aerial roots, record the aerial root figure number that best represents the density and branching structure of the aerial root system. If there are no aerial roots, record 0 for this column.

When Collected: All live and standing dead tally trees >= 5.0 in d.b.h.
Field width: 1 digit
Tolerance: No errors
Values: 0 (no aerial roots) and 1 to 3(as shown below)

Aerial roots = 1

Aerial roots = 2

Aerial roots = 3

10.19 ACTUAL LENGTH (CORE 5.15) [ACTUALHT]

For microplots with excessive saplings (20 or more) see "*Microplots with excessive saplings*" on page 134 for special coding instructions to help speed up the measurement of microplots.

Record for trees with missing tops (top on live trees is completely detached; top on dead trees is greater than 50 percent detached from the tree). If the top is intact, this item may be omitted. Record the ACTUAL LENGTH of the tree to the nearest 1.0 foot from ground level to the break. Use the length to the break for ACTUAL LENGTH until a new leader qualifies as the new top for TOTAL LENGTH; until that occurs, continue to record ACTUAL LENGTH to the break. Trees with previously broken tops are considered recovered (i.e., ACTUAL LENGTH = TOTAL LENGTH) when a new leader (dead or alive) is 1/3 the diameter of the broken top at the point where the top was broken (not where the new leader originates from the trunk). Forked trees should be treated the same as unforked trees.

> When Collected: All live tally trees ≥1.0 in DBH and standing dead tally trees ≥ 5.0 in DBH
> Field width: 3 digits
> Tolerance: +/- 10 % of true length
> MQO: At least 90% of the time
> Values: 005 to 400

10.20 TOTAL LENGTH (CORE 5.14) [HT]

For microplots with excessive saplings (20 or more) see "*Microplots with excessive saplings*" on page 134 for special coding instructions to help speed up the measurement of microplots.

Record the TOTAL LENGTH of the tree, to the nearest 1.0 foot from ground level to the top of the tree. For trees growing on a slope, measure on the uphill side of the tree. If the tree has a missing top (top is broken and completely detached from the tree), estimate what the total length would be if there were no missing top. Forked trees should be treated the same as unforked trees.

> When Collected: All live tally trees ≥ 1.0 in DBH and all standing dead tally trees ≥ 5.0 in DBH
> Field width: 3 digits
> Tolerance: +/- 10 % of true length
> MQO: At least 90% of the time
> Values: 005 to 400

10.21 LENGTH METHOD (CORE 5.16) [HTCD]

For microplots with excessive saplings (20 or more) see "*Microplots with excessive saplings*" on page 134 for special coding instructions to help speed up the measurement of microplots.

Record the code that indicates the method used to determine tree lengths.

When Collected: All live tally trees > 1.0 in DBH and all standing dead tally trees > 5.0 in DBH
Field width: 1 digit
Tolerance: No errors
MQO: At least 99% of the time
Values:

1 Total and actual lengths are field measured with a measurement instrument (e.g., clinometer, relaskop, tape)

2 Total length is visually estimated, actual length is measured with an instrument.

3 Total and actual lengths are visually estimated.

10.22 UNCOMPACTED LIVE CROWN RATIO (CORE 5.18) [UNCRCD]

Record the UNCOMPACTED LIVE CROWN RATIO to the nearest one percent. UNCOMPACTED LIVE CROWN RATIO is the percentage of actual tree length supporting live foliage (or in cases of extreme defoliation should be supporting live foliage) that is effectively contributing to tree growth. UNCOMPACTED LIVE CROWN RATIO is determined by the ratio of live crown length to ACTUAL LENGTH (fig. 40). Live crown length is determined from the last live foliage at the crown top (dieback in the upper portion of the crown is not part of the live crown) to the “base of live crown”. Many times there are additional live branches below the “base of live crown”. These branches are only included if they have a basal diameter greater than 1 inch and are within 5 feet of the base of the obvious live crown. The live crown base becomes that point on the main bole perpendicular to the lowest live foliage on the last branch that is included in the live crown. The live crown base is determined by the live foliage and not by the point where a branch intersects with the main bole.

When Collected: All live tally trees ≥ 1.0 in DBH
Field width: 2 digits
Tolerance: +/- 10 %
MQO: At least 90% of the time
Values: 00 to 99

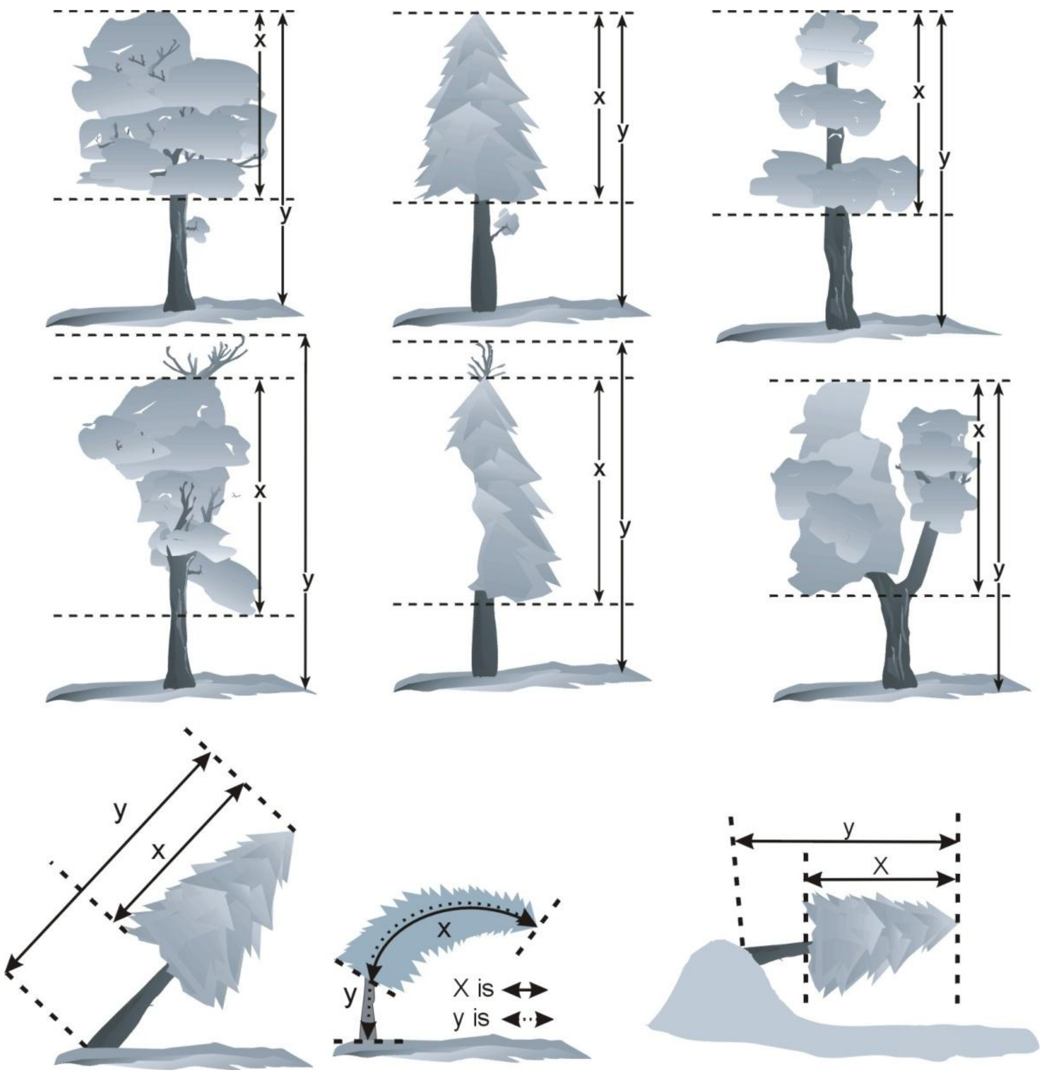


Figure 40. UNCOMPACTED LIVE CROWN RATIO examples.

<u>Determine sapling UNCOMPACTED LIVE CROWN RATIO by dividing the live crown length by ACTUAL LENGTH. Live crown length is the distance between the top live foliage (dieback and dead branches are not included) and the lowest live twig for saplings. The live crown base for saplings is different from trees 5.0 inches DBH and larger; the 1-inch/5-foot rule does not apply in this case. Do not include sprigs or leaves on the main stem below the lowest live twig (fig. 41).</u>

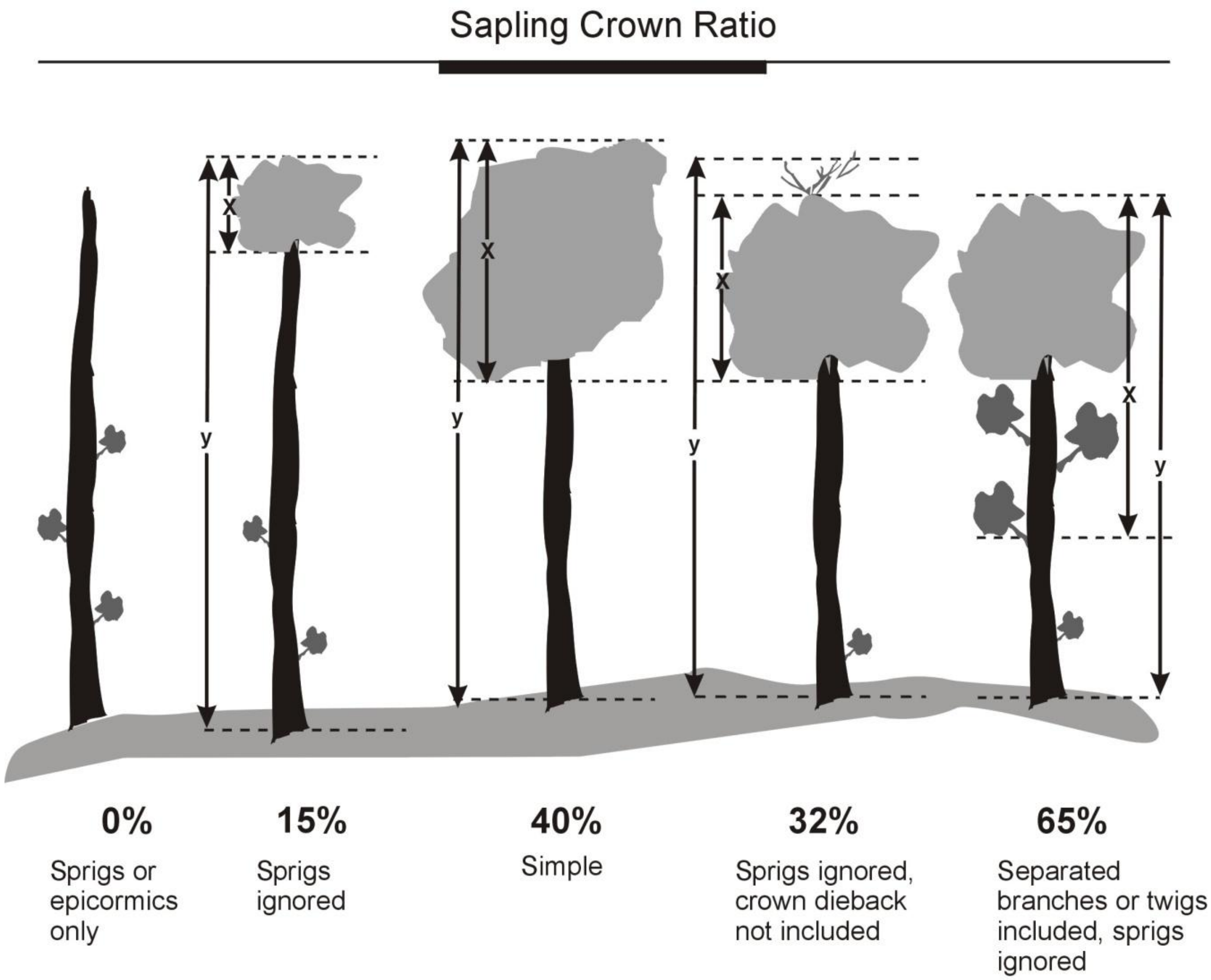


Figure 41. Sapling ratio determination examples

10.23 COMPACTED CROWN RATIO (CORE 5.19) [CR]

Record the COMPACTED CROWN RATIO for each live tally tree, 1.0 inch and larger, to the nearest one percent. COMPACTED CROWN RATIO is that portion of the tree supporting live foliage (or in the case of extreme defoliation should be supporting live foliage) and is expressed as a percentage of the actual tree length. To determine COMPACTED CROWN RATIO, ocularly transfer lower live branches to fill in large holes in the upper portion of the tree until a full, even crown is visualized.

Do not over-compact trees beyond their typical full crown situation. For example, if tree branches tend to average 2 feet between whorls, do not compact crowns any tighter than the 2-foot spacing (fig. 42). Figure 45 shows an example of COMPACTED CROWN RATIO on a leaning tree.

When Collected: All live tally trees ≥ 1.0 in DBH
Field width: 2 digits
Tolerance: +/- 10 %
MQO: At least 80% of the time
Values: 00 to 99

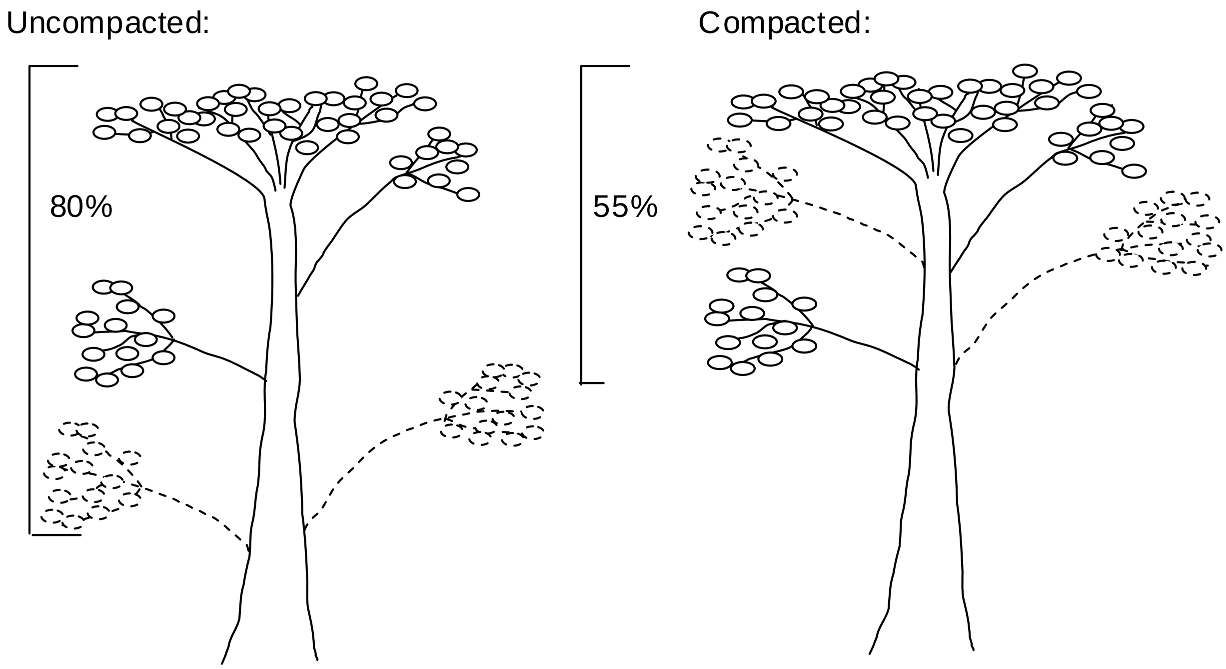


Figure 42. Example of Crown Ratio on Open-crown tree (e.g., Terminalia catappa)

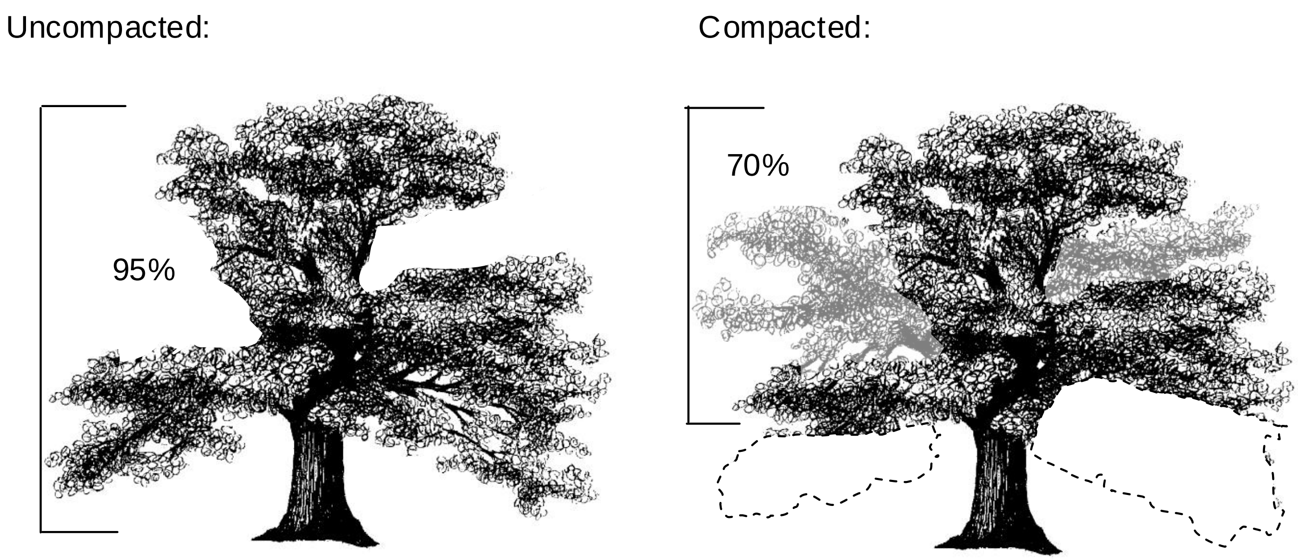


Figure 43. Example of Crown Ratio on Dense-crown tree (e.g., Mangifera indica)

Uncompacted Ratio = 70%
Compacted Ratio = 70%

Figure 44. Compacted and Uncompacted crown ratios will be the same for tree ferns and palm trees except when fronds or large parts of fronds are missing.

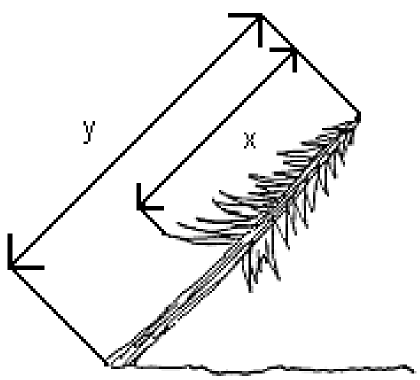


Figure 45. Compacted crown ratio on a leaning tree. Compacted crown ratio = (x/y)100.

10.24 CROWN CLASS (CORE 5.17) [CCLCD]

Rate tree crowns in relation to the sunlight received and proximity to neighboring trees (Figure 46). Base the assessment on the position of the crown at the time of observation. Example: a formerly suppressed tree which is now dominant due to tree removal is classified as dominant.

When Collected: All live tally trees > 1.0 in DBH
Field width: 1 digit
Tolerance: No errors
MQO: At least 85% of the time

Values:

1 Open Grown: Trees with crowns that received full light from above and from all sides throughout most of its life, particularly during its early developmental period.

2 Dominant: Trees with crown extending above the general level of the crown canopy and receiving full light from above and partly from the sides. These trees are taller than the average trees in the stand and their crowns are well developed, but they could be somewhat crowded on the sides. Also, trees whose crowns have received full light from above and from all sides during early development and most of their life. Their crown form or shape appears to be free of influence from neighboring trees.

3 Co-dominant: Trees with crowns at the general level of the crown canopy. Crowns receive full light from above but little direct sunlight penetrates their sides. Usually they have medium-sized crowns and are somewhat crowded from the sides. In stagnated stands, co-dominant trees have small-sized crowns and are crowded on the sides.

4 Intermediate: Trees that are shorter than dominants and co-dominant, but their crowns extend into the canopy of co-dominant and dominant trees. They receive little direct light from above and none from the sides. As a result, intermediates usually have small crowns and are very crowded from the sides.

5 Overtopped: Trees with crowns entirely below the general level of the crown canopy that receive no direct sunlight either from above or the sides.

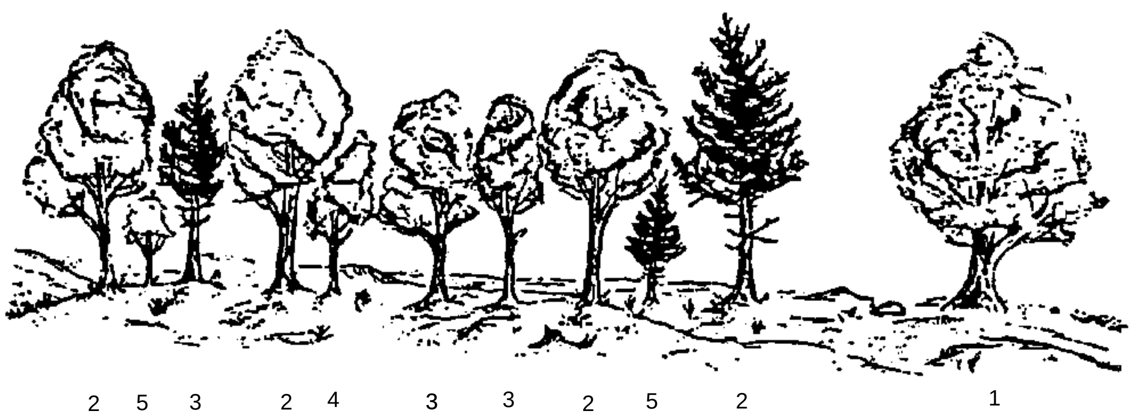


Figure 46. Examples of CROWN CLASS code definitions

10.25 TREE DAMAGE

Record up to two different damages per tree. Record damage for all saplings and trees at least 1.0 in DBH. Damage is characterized according to four attributes: location of damage, type of damage, severity of damage, and damaging agent. Damages must meet severity thresholds (defined in section 10.25.3, DAMAGE SEVERITY) in order to be recorded.

The tree is observed from all sides starting at the roots. Damage signs and symptoms are prioritized and recorded based on location in the following order: roots, roots and lower bole, lower bole, lower and upper bole, upper bole, crownstem, and branches recorded as DAMAGE LOCATION 1-9, or record location code 0 (for no damage).

Within any given location, the hierarchy of damage follows the numeric order of DAMAGE TYPE possible for that location. The numeric order denotes decreasing significance as the code number goes up, i.e., DAMAGE TYPE 01 is more significant than DAMAGE TYPE 25. A maximum of two damages are recorded for each tree. If a tree has more than two damages that meet the threshold levels, the first two that are observed starting at the roots are recorded.

When multiple damages occur in the same place, the most damaging is recorded. For example, if a canker, DAMAGE TYPE 02, meets the threshold and has a conk growing in it, record only the canker. Another example: if an open wound meets threshold and also has resinosis, record only the open wound.

Damage Summary

If a live tally tree with a DBH of 1 inch or greater has damage, you must code 4 items;

1. DAMAGE LOCATION
2. DAMAGE TYPE
3. DAMAGE SEVERITY
4. DAMAGE AGENT

A. Does the tree have DAMAGE in these locations?

1 = Roots (exposed) and Stump (12 in. in height from ground level)
2 = Roots, stump, and lower bole

Then valid DAMAGE TYPE codes are**:**

01. Canker, gall (>20% circumference)
    Valid SEVERITY codes = 2 through 9
02. Conks, advanced decay, ROT
    Valid SEVERITY codes = 0
03. Open wounds (>20% circumference)
    Valid SEVERITY codes = 2 through 9
04. Resin flowing from bole (>20% circumference)
    Valid SEVERITY codes = 2 through 9
05. Cracks and seams
    Valid SEVERITY codes = 0
11. Broken bole or broken roots within 3 feet of the stump
    Valid SEVERITY codes = 0
12. Brooms on roots or bole
    Valid SEVERITY codes = 0
13. Broken or dead roots beyond 3 feet of the bole (>20% of roots broken or dead)
    Valid SEVERITY codes = 2 through 9
31. Other
    Valid SEVERITY codes = 0

B. Does the tree have DAMAGE in these locations?

3 = Lower Bole (lower half of the trunk between stump and base of live crown

4 = Lower and Upper Bole

5 = Upper Bole (upper half of trunk between stump and base of live crown

Then valid DAMAGE TYPE codes are:

1. Canker, gall (>20% circumference)
   Valid SEVERITY codes = 2 through 9
2. Conks, advanced decay, ROT
   Valid SEVERITY codes = 0
3. Open wounds (>20% circumference)
   Valid SEVERITY codes = 2 through 9
4. Resin flowing from bole (>20% circumference)
   Valid SEVERITY codes = 2 through 9
5. Cracks and seams
   Valid SEVERITY codes = 0

11. Broken bole or broken roots within 3 feet of the stump
    Valid SEVERITY codes = 0
12. Brooms on roots or bole
    Valid SEVERITY codes = 0

31. Other
    Valid SEVERITY codes = 0

C. Does the tree have DAMAGE in these locations?

6 = Crownstem (main stem within the live crown area, above the base of the live crown

Then valid DAMAGE TYPE codes are:

1. Canker, gall (>20% circumference)
   Valid SEVERITY codes = 2 through 9
2. Conks, advanced decay, ROT
   Valid SEVERITY codes = 0
3. Open wounds (>20% circumference)
   Valid SEVERITY codes = 2 through 9
4. Resin flowing from bole (>20% circumference)
   Valid SEVERITY codes = 2 through 9
5. Cracks and seams
   Valid SEVERITY codes = 0

21. Loss of apical dominance, dead terminal (broken or dead top)
    Valid SEVERITY codes = 0 through 9
31. Other
    Valid SEVERITY codes = 0

D. Does the tree have DAMAGE in these locations?

7 = Branches > 1 inch where the branch attaches to the main **bole or crown stem**

Then valid DAMAGE TYPE codes are:

1. Canker, gall (>20% circumference)
   Valid SEVERITY codes = 2 through 9
2. Conks, advanced decay, ROT
   Valid SEVERITY codes = 0
3. Open wounds (>20% circumference)
   Valid SEVERITY codes = 2 through 9
4. Resin flowing from bole (>20% circumference)
   Valid SEVERITY codes = 2 through 9
5. Cracks and seams
   Valid SEVERITY codes = 0

20. Vines in the crown (>20% of crown affected)
    Valid SEVERITY codes = 2 through 9
22. Broken or dead (>20% of branches affected in the live crown area)
    Valid SEVERITY codes = 2 through 9
23. Excessive branching or brooms (>20% of branches affected)
    Valid SEVERITY codes = 2 through 9
31. Other
    Valid SEVERITY codes = 0

E. Does the tree have DAMAGE in these locations?
8 = Buds and Shoots (the most recent year's growth)

Then valid DAMAGE TYPE codes are:

24. Damaged buds, shoots, or foliage (>30% of buds and shoots damaged > 50%)
    Valid SEVERITY codes = 3 through 9
31. Other
    Valid SEVERITY codes = 0

F. Does the tree have DAMAGE in these locations?
9 = Foliage

Then valid DAMAGE TYPE codes are:

24. Damaged buds, shoots, or foliage (>30% of buds and shoots damaged > 50%)
    Valid SEVERITY codes = 3 through 9
25. Discoloration of foliage (>30% of foliage discolored > 50%)
    Valid SEVERITY codes = 3 through 9
31. Other
    Valid SEVERITY codes = 0

Valid Damage agent codes for all damages:

10 Insects
20 Disease
30 Fire
40 Animal
47 Wild Pigs
50 Weather
60 Vegetation (suppression, competition, vines/mile-a-minute, etc)
70 Unknown/not sure/other (include notes
80 Human-caused (cultural, logging, accidental, etc)
90 Physical (hit by falling tree, rockslides, etc)
99 Unknown

10.25.1 DAMAGE LOCATION 1 (CORE 5.20.1) [DAMLOC1]

Record the location on the tree where DAMAGE TYPE 1 is found (fig. 48). If the same damage continues into two or more locations, record the appropriate code, or if the combination of locations does not exist (damage extends from crownstem to roots), record the lowest location that best describes the damage (see fig. 47). Multiple damages may occur in the same location, but record the higher priority damage (lower code number) first. If the damages are coincident (a conk within a canker), record only the higher priority damage.

The "base of the live crown" is defined as the horizontal line which would touch the lowest part of the foliage, excluding branches towards the base of the tree which are less than 1.0 inch or more than 5 ft from the rest of the crown. See Section 10.22 on page **163**(UNCOMPACTED LIVE CROWN RATIO) for more details.

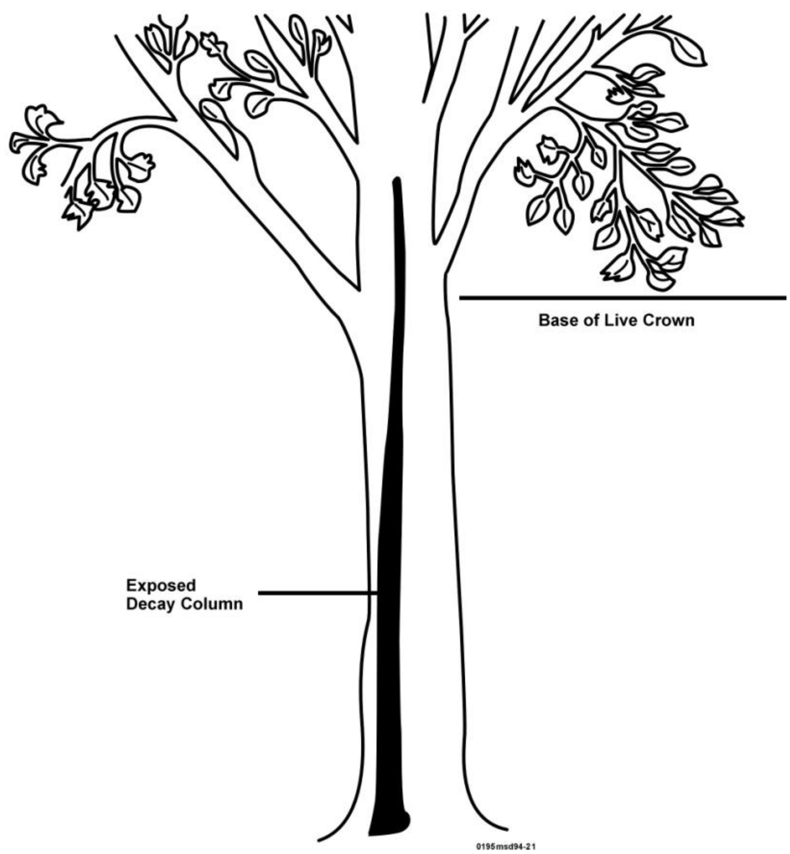


Figure 47. The damage runs from stump to crownstem. Code here should be 02 (roots and "stump" and lower bole) which represents the lowest locations of this multi-location damage.

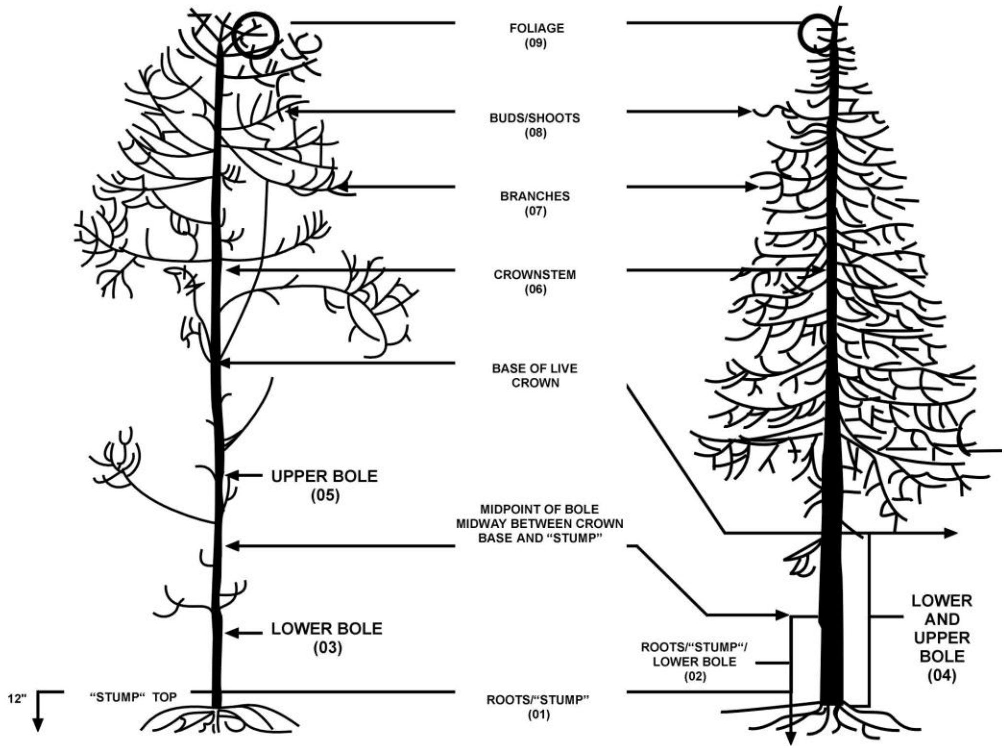


Figure 48. Location codes for damage

When Collected: All live tally trees ≥ 1.0 in DBH
Field width: 1 digit
Tolerance: +/- 1 location class
MQO: At least 80% of the time
Values:

0	No damage
1	Roots (exposed) and stump (12 inches in height from ground level)
2	Roots, stump, and lower bole
3	Lower bole (lower half of the trunk between the stump and base of the live crown)
4	Lower and upper bole
5	Upper bole (upper half of the trunk between stump and base of the live crown)
6	Crownstem (main stem within the live crown area, above the base of the live crown)
7	Branches (>1 in at the point of attachment to the main crown stem within the live crown area)
8	Buds and shoots (the most recent year's growth)
9	Foliage

10.25.2 DAMAGE TYPE 1 (CORE 5.20.2) [DAMTYP1]

Record the first damage type observed that meets the damage threshold definition in the lowest location. Damage categories are recorded based on the numeric order that denotes decreasing significance from damage 01 - 31.

When Collected: All tally trees where DAMAGE LOCATION 1 > 0
Field width: 2 digits
Tolerance: No errors
MQO: At least 80% of the time
Values:

1 Canker, gall: Cankers may be caused by various agents but are most often caused by fungi. The bark and cambium are killed, and this is followed by death of the underlying wood, although the causal agent may or may not penetrate the wood. This results in areas of dead tissue that become deeper and wider, or galling (including galls caused by rusts), on roots, bole, or branches. Due to the difficulty in distinguishing some abnormal swellings (e.g., burls) from classic galls and cankers, all are recorded as damage 01. A canker may be:

Annual (enlarges only once and does so within an interval briefer than the growth cycle of the tree, usually less than one year),

Diffuse (enlarges without characteristic shape or noticeable callus formation at margins), or

Perennial (enlarges during more than one year - often has a target appearance).

2 Conks, fruiting bodies, and signs of advanced decay: Fruiting bodies on the main bole, crownstem, and at the point of the branch attachment are signs of decay. "Punky wood" is a sign of decay and is evidenced by soft, often moist, and degraded tissue.

Cavities into the main bole that are oriented in such a way that they act as catchment basins for water are signs of decay. Bird cavities are signs of decay.

Rotten branches or branches with conks **are not indicators of decay unless** the threshold is met (>20% of branches are affected).

Rotting stumps associated with coppice regeneration (e.g., northern pin oak, maple) are excluded from coding.

3 Open wounds: An opening or series of openings where bark has been removed or the inner wood has been exposed and no signs of advanced decay are present. Improper pruning wounds that cut into the wood of the main stem are coded as open wounds, if they meet the threshold; those which leave the main stemwood intact are excluded.

4 Resinosis or gummosis: The origin of areas of resin or gum (sap) exudation on branches and trunks.

5 Cracks and seams: Cracks in trees are separations along the radial plane greater than or equal to 5 ft. When they break out to the surface they often are called frost cracks. These cracks are not caused by frost or freezing temperature, though frost can be a major factor in their continued development. Cracks are most often caused by basal wounds or sprout stubs, and expand when temperatures drop rapidly. Seams

develop as the tree attempts to seal the crack, although trees have no mechanism to compartmentalize this injury.

Lightning strikes are recorded as cracks when they do not meet the threshold for open wounds.

11 Broken bole or roots (less than 3 ft from bole): Broken roots within 3 ft from bole either from excavation or rootsprung for any reason. For example, those which have been excavated in a road cut or by animals.

Stem broken in the bole area (below the base of the live crown) and tree is still alive.

12 Brooms on roots or bole: Clustering of foliage about a common point on the trunk. Examples include ash yellows witches' brooms on white and green ash and eastern and western conifers infected with dwarf mistletoes.

13 Broken or dead roots (beyond 3 ft): Roots beyond 3 ft from bole that are broken or dead.

20 Vines in the crown: Kudzu, grapevine, ivy, dodder, etc. smothers tree crowns. Vines are rated as a percentage of tree crown affected.

21 Loss of apical dominance, dead terminal: Mortality of the terminal of the crownstem caused by frost, insect, pathogen, or other causes.

22 Broken or dead: Branches that are broken or dead. Branches with no twigs are ignored and not coded as dead. Dead or broken branches attached to the bole or crownstem outside the live crown area are not coded. 20% of the main, first order portion of a branch must be broken for a branch to be coded as such.

23 Excessive branching or brooms within the live crown area: Brooms are a dense clustering of twigs or branches arising from a common point that occur within the live crown area. Includes abnormal clustering of vegetative structures and organs. This includes witches' brooms caused by ash yellows on green and white ash and those caused by dwarf mistletoes.

24 Damaged buds, foliage or shoots: Insect feeding, shredded or distorted foliage, buds or shoots >50% affected, on at least 30% of foliage, buds or shoots. Also includes herbicide or frost-damaged foliage, buds or shoots.

25 Discoloration of foliage: At least 30% of the foliage is more than 50% affected. Affected foliage must be more of some color other than green. If the observer is unsure if the color is green, it is considered green and not discolored.

31 Other: Use when no other explanation is appropriate. Specify in the tree notes section. Code 31 is used to maintain consistency with the Phase 3 crown damage protocols.

Legal Combinations of DAMAGE TYPE by DAMAGE LOCATION:

For each of the following location codes, possible damage codes and damage definitions are presented. Minimum damage thresholds are described in Section 10.25.3, DAMAGE SEVERITY.

Location 1: Roots and stump

01 Canker, gall -- exceeds 20% of circumference of stump
02 Conks, fruiting bodies, and signs of advanced decay -- any occurrence
03 Open wounds -- exceeds 20% of circumference of stump
04 Resinosis or gummosis -- origin of flow width exceeds 20% of circumference of stump
05 Cracks and seams -- any occurrence
11 Broken bole or roots less than 3 feet from bole -- any occurrence
12 Brooms on roots or bole -- any occurrence.
13 Broken or dead roots -- exceeds 20% of roots, beyond 3 feet from bole, broken or dead
31 Other

Location 2: Roots, stump, and lower bole

01 Canker, gall -- exceeds 20% of circumference of stump
02 Conks, fruiting bodies, and signs of advanced decay -- any occurrence
03 Open wounds – exceeds 20% at the point of occurrence, or for the portion in root zone, 20% of the circumference of stump
04 Resinosis or gummosis -- origin of flow width exceeds 20% at the point of occurrence, or for the portion in root zone, 20% of circumference of stump.
05 Cracks and seams - any occurrence
11 Broken bole or roots less than 3 feet from bole -- any occurrence
12 Brooms on roots or bole - -any occurrence.
13 Broken or dead roots -- exceeds 20% of roots, beyond 3 feet from bole, broken or dead
31 Other

Location 3: Lower bole

01 Canker, gall -- exceeds 20% of circumference at the point of occurrence
02 Conks, fruiting bodies, and signs of advanced decay -- any occurrence
03 Open wounds -- exceeds 20% of circumference at the point of occurrence
04 Resinosis or gummosis -- origin of flow width exceeds 20% of circumference at the point of occurrence
05 Cracks and seams -- any occurrence
11 Broken bole or roots less than 3 feet from bole -- any occurrence
12 Brooms on roots or bole -- any occurrence
31 Other

Location 4: Lower and upper bole -- same as lower bole.

Location 5: Upper bole - same as lower bole.

Location 6: Crownstem

01 Canker, gall -- exceeds 20% of circumference of crownstem at the point of occurrence
02 Conks, fruiting bodies, and signs of advanced decay -- any occurrence
03 Open wounds - exceeds 20% of circumference at the point of occurrence -- any occurrence
04 Resinosis or gummosis -- origin of flow width exceeds 20% of circumference at the point of occurrence
05 Cracks and seams -- all woody locations -- any occurrence.
21 Loss of apical dominance, dead terminal -- any occurrence
31 Other

Location 7: Branches >1 in at the point of attachment to the main or crown stem

- 01 Canker, gall -- exceeds 20% of circumference on at least 20% of branches
- 02 Conks, fruiting bodies and signs of advanced decay -- more than 20% of branches affected
- 03 Open wounds -- exceeds 20% of circumference at the point of occurrence on at least 20% of branches
- 04 Resinosis or gummosis -- origin of flow width exceeds 20% of circumference at the point of occurrence on at least 20% of branches
- 05 Cracks and seams -- all occurrences, and on at least 20% of branches
- 20 Vines in the crown -- more than 20% of live crown affected
- 22 Broken or dead -- more than 20% of branches affected within the live crown area, except for woodland species where there is no requirement that damage to branches can only occur to branches that originate within the live crown area.
- 23 Excessive branching or brooms -- more than 20% of branches affected
- 31 Other

Location 8: Buds and shoots

- 24 Damaged buds, shoots or foliage - more than 30% of buds and shoots damaged more than 50%.
- 31 Other.

Location 9: Foliage

- 24 Damaged buds, shoots or foliage - more than 30% of foliage damaged more than 50%.
- 25 Discoloration of foliage - more than 30% of foliage discolored more than 50%.
- **31 Other.**

10.25.3 DAMAGE SEVERITY 1 (CORE 5.20.3) DAMSEV1]

Record a code to indicate the amount of affected area (above threshold) in DAMAGE LOCATION 1 recorded for TREE DAMAGE 1. Severity codes vary depending on the type of damage recorded.

When Collected: All tally trees where DAMAGE LOCATION 1 > 0
Field width: 1 digit
Tolerance: +/- 1 valid class unless otherwise defined by the DAMAGE TYPE
MQO: At least 80% of the time
Values: The codes and procedures for SEVERITY 1 values are defined for each DAMAGE TYPE 1.

DAMAGE TYPE Code 01 -- Canker, gall

Measure the affected area from the margins (outer edges) of the canker or gall within any 3-ft vertical section in which at least 20% of circumference is affected at the point of occurrence. For location 7, and location 1, 20% of branches and roots beyond 3 ft, respectively, must be affected, then record in 10% classes. See Figure 49.

Severity classes for code 01 (percent of circumference affected):

Classes	Code
20-29	2
30-39	3
40-49	4
50-59	5
60-69	6
70-79	7
80-89	8
90-99	9

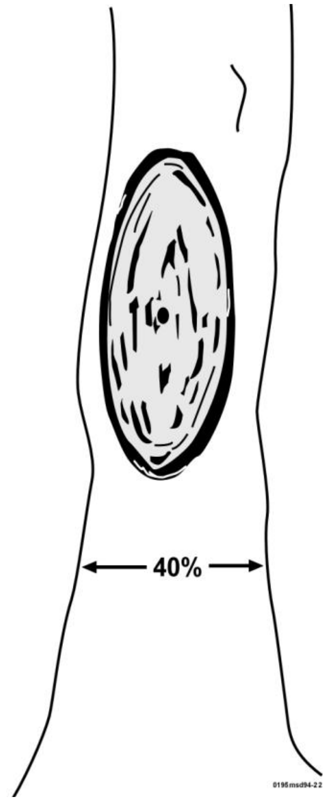


Figure 49. A canker which exceeds threshold. Since 40% of circumference is visible from any side, and since over half the visible side is taken up by the canker, it obviously exceeds the 20% minimum circumference threshold.

DAMAGE TYPE Code 02 -- Conks, fruiting bodies, and signs of advanced decay

Severity classes for code 02: **None**. Enter code 0 regardless of severity, except for roots > 3 ft from the bole, or number of branches affected - 20%

DAMAGE TYPE Code 03 -- Open wounds

The damaged area is measured at the widest point between the margins of the exposed wood within any 3-ft vertical section in which at least 20% of the circumference is affected at the point of occurrence. For location 7, and location 1, 20% of branches and roots beyond 3 ft, respectively, must be affected, then record in 10% classes. See Figure 50.

Severity Classes for code 03 (percent of circumference affected):

Classes	Code
20-29	2
30-39	3
40-49	4
50-59	5
60-69	6
70-79	7
80-89	8
90-99	9

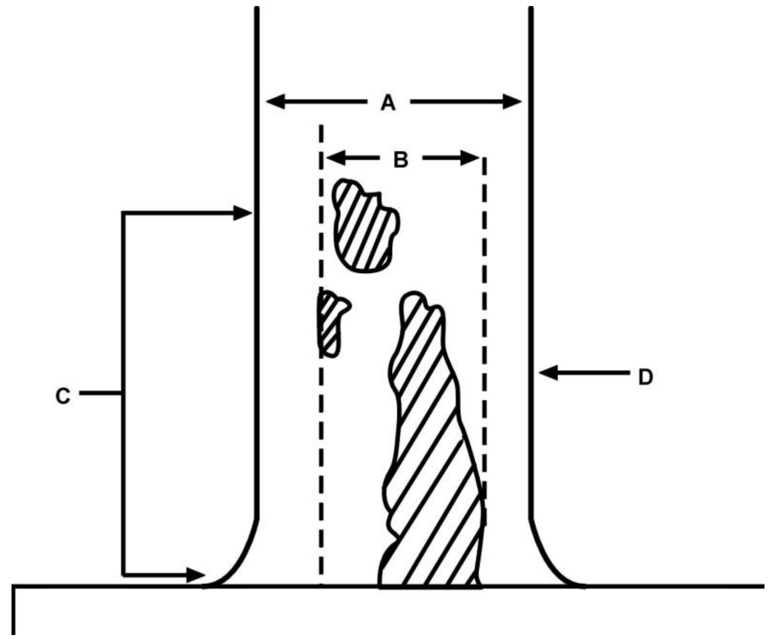


Figure 50. Multiple damage in "stump" and lower bole. A=approximately 40% of tree circumference; B=portion of tree circumference affected by damage; C=vertical distance within one meter; D=midpoint of occurence at which circumference is measured.

DAMAGE TYPE Code 04 -- Resinosis or gummosis

Resinosis or gummosis is measured at the widest point of the origin of the flow width in which at least 20% of the circumference is affected at the point of occurrence. For location 7, and location 1, 20% of branches and roots beyond 3 ft, respectively, must be affected, then record in 10% classes.

Severity classes for code 04 (percent of circumference affected):

Classes	Code
20-29	2
30-39	3
40-49	4
50-59	5
60-69	6
70-79	7
80-89	8
90-99	9

DAMAGE TYPE Code 05 -- Cracks and seams greater than or equal to 5 ft

Severity class for code 05 -- Record "0" for the lowest location in which the crack occurs. For location 7, and location 1, 20% of branches and roots beyond 3 ft, respectively, must be affected, then record in 10% classes.

DAMAGE TYPE Code 11 -- Broken bole or roots less than 3 ft from bole

Severity classes for code 11: None. Enter code 0 regardless of severity.

DAMAGE TYPE Code 12 -- Brooms on roots or bole

Severity classes for code 12: None. Enter code 0 regardless of severity.

DAMAGE TYPE Code 13 -- Broken or dead roots

At least 20% of roots beyond 3 ft from bole that are broken or dead.

Severity classes for code 13 (percent of roots affected):

Classes	Code
20-29	2
30-39	3
40-49	4
50-59	5
60-69	6
70-79	7
80-89	8
90-99	9

DAMAGE TYPE Code 20 -- Vines in crown

Severity classes for code 20 (percent of live crown affected):

Classes	Code
20-29	2
30-39	3
40-49	4
50-59	5
60-69	6
70-79	7
80-89	8
90-99	9

DAMAGE TYPE Code 21 -- Loss of apical dominance, dead terminal

Any occurrence (> 1%) is recorded in 10% classes as a percent of the crownstem affected. Use trees of the same species and general DBH class in the area or look for the detached portion of the crownstem on the ground to aid in estimating percent affected. If a lateral branch has assumed the leader and is above where the previous terminal was, then no damage is recorded.

Severity classes for code 21:

Classes	Code
01-09	0
10-19	1
20-29	2
30-39	3
40-49	4
50-59	5
60-69	6
70-79	7
80-89	8
90-99	9

DAMAGE TYPE Code 22 -- Broken or dead branches (> 1in above the swelling at the point of attachment to the main or crown stem within the live crown area)

At least 20% of branches are broken or dead.

Severity classes for code 22 (percent of branches affected):

Classes	Code
20-29	2
30-39	3
40-49	4
50-59	5
60-69	6
70-79	7
80-89	8
90-99	9

DAMAGE TYPE Code 23 -- Excessive branching or brooms

At least 20% of crownstem or branches affected with excessive branching or brooms.

Severity classes for code 23 (percent of area affected):

Classes	Code
20-29	2
30-39	3
40-49	4
50-59	5
60-69	6
70-79	7
80-89	8
90-99	9

DAMAGE TYPE Code 24 - Damaged buds, shoots or foliage

At least 30% of the buds, shoots or foliage (i.e., chewed or distorted) are more than 50% affected.

Severity classes for code 24:

Classes	Code
30-39	3
40-49	4
50-59	5
60-69	6
70-79	7
80-89	8
90-99	9

DAMAGE TYPE Code 25 - Discoloration of Foliage

At least 30% of the foliage is more than 50% affected.

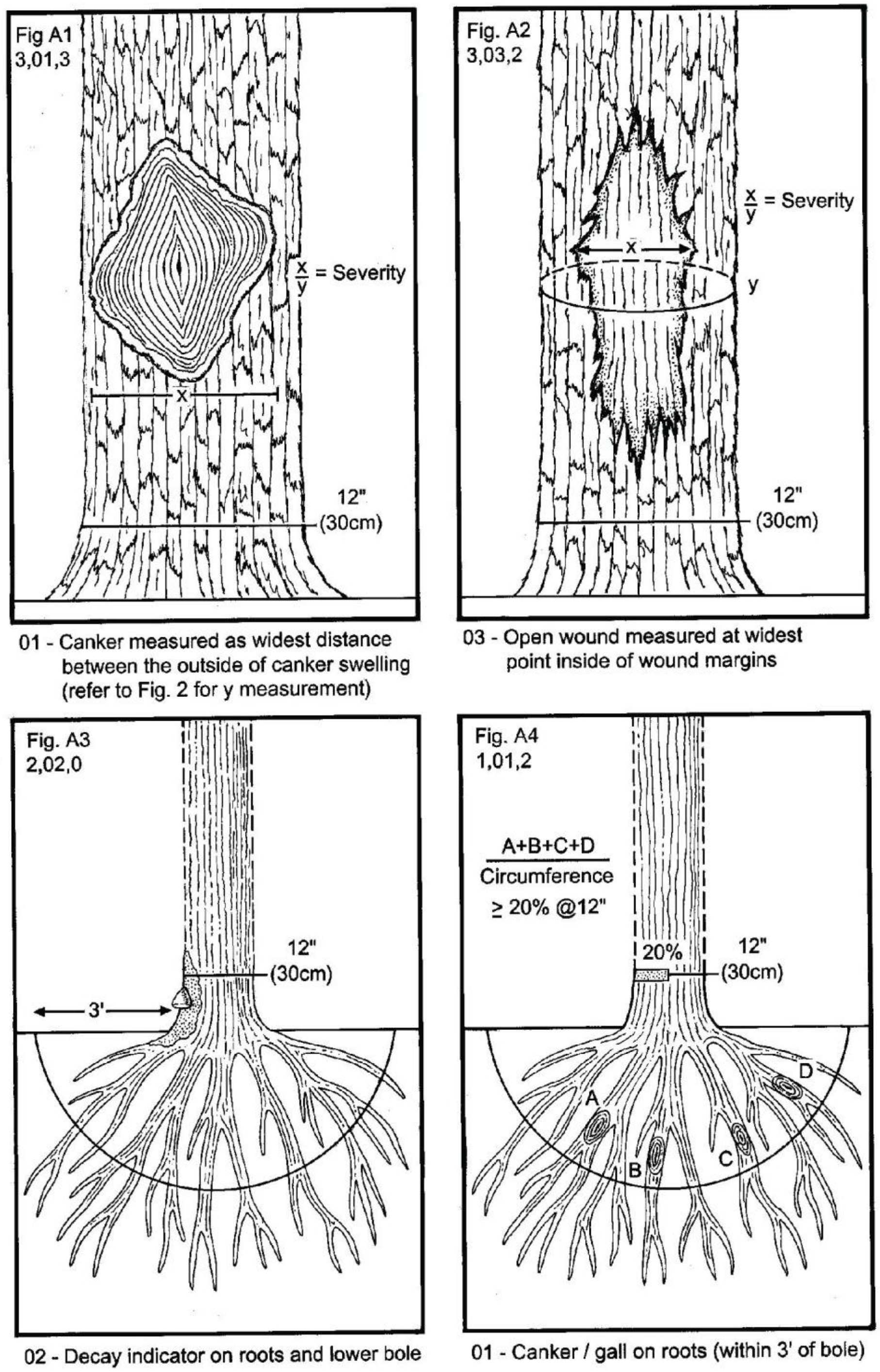
Severity classes for code 25 (percent affected):

Classes	Code
30-39	3
40-49	4
50-59	5
60-69	6
70-79	7
80-89	8
90-99	9

DAMAGE TYPE Code 31 -- Other

Severity classes for code 31:

None. Enter code 0 regardless of severity. Describe condition in tree notes. Examples are shown in Figures 51-57.



01 - Canker measured as widest distance between the outside of canker swelling (refer to Fig. 2 for y measurement)

03 - Open wound measured at widest point inside of wound margins

02 - Decay indicator on roots and lower bole

01 - Canker / gall on roots (within 3' of bole)

Figure 51. Examples of damage coding.

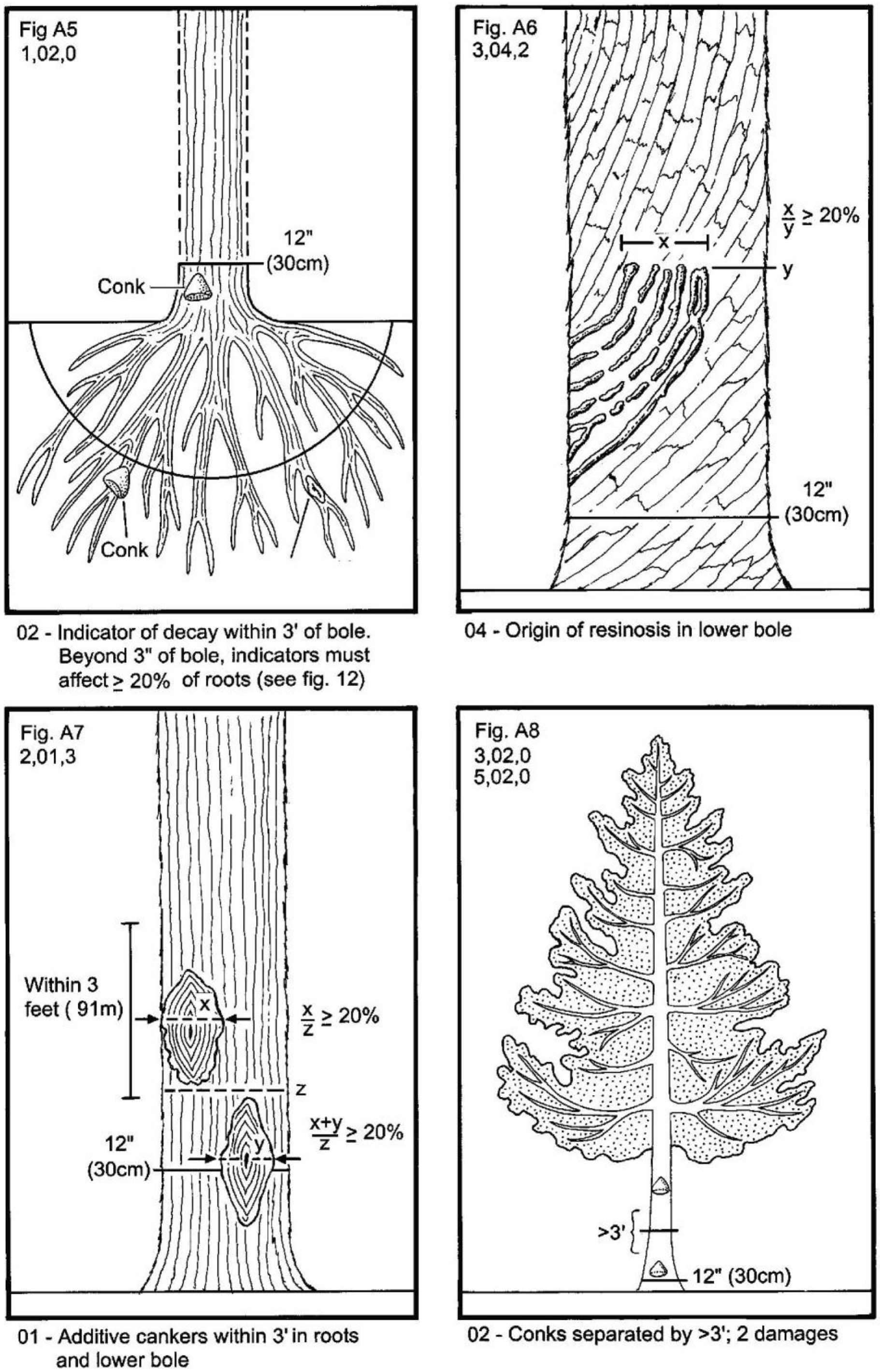
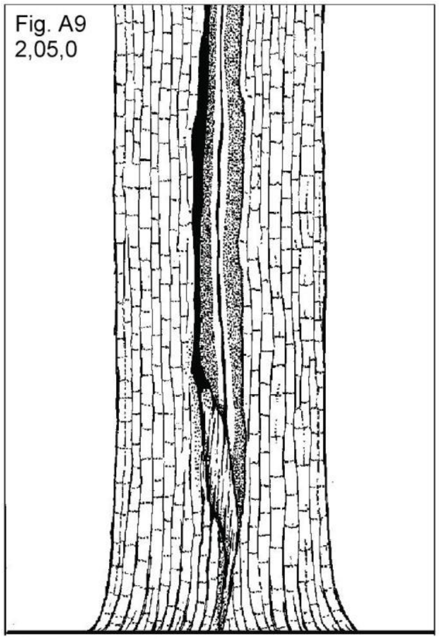
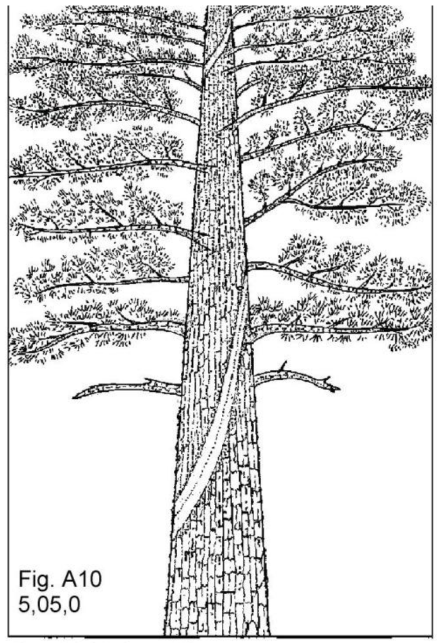


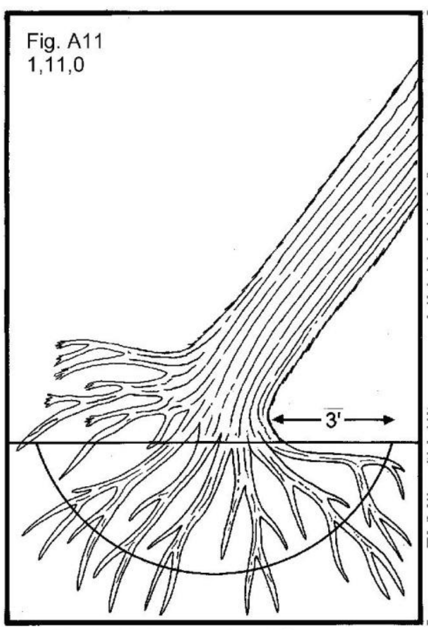
Figure 52. Examples of damage coding.



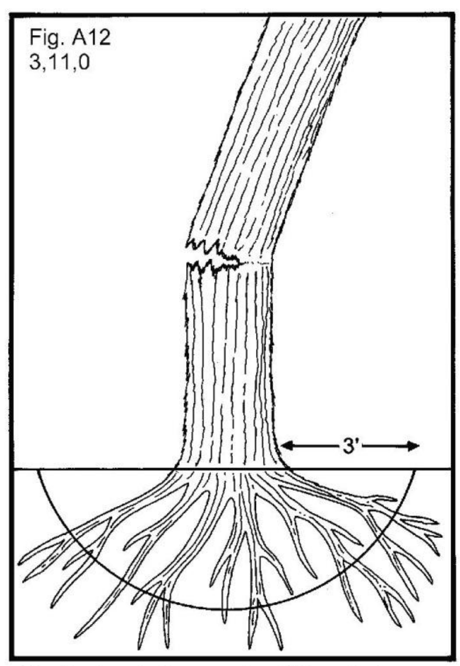
05- Cracks and seams



05 - Lightning strike

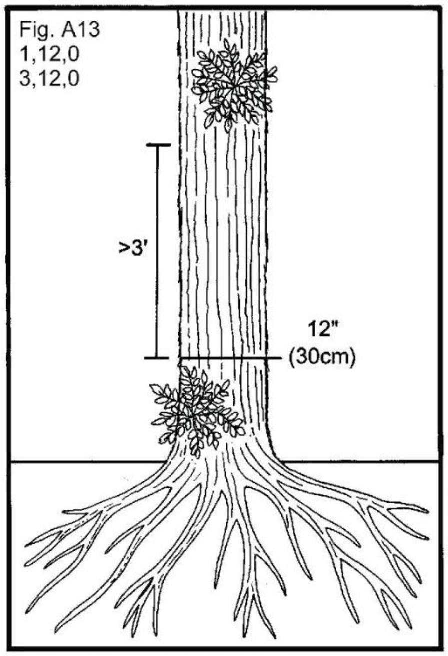


11 - Broken bole or roots <3' from bole, broken roots must be visible

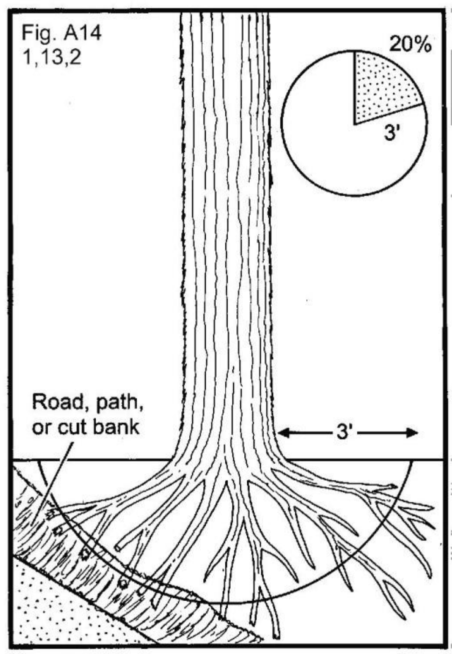


11 - Broken bole or roots <3' from bole

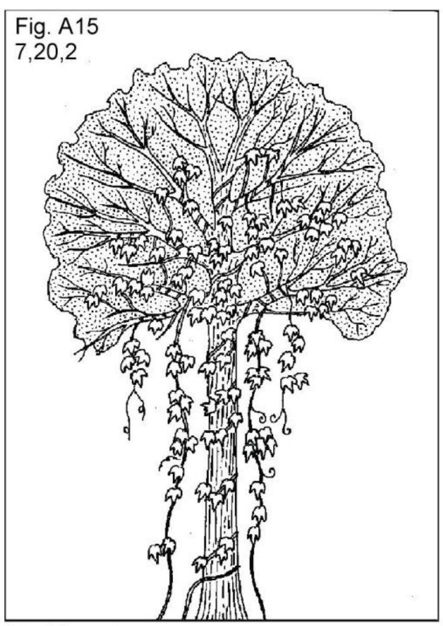
Figure 53. Examples of damage coding.



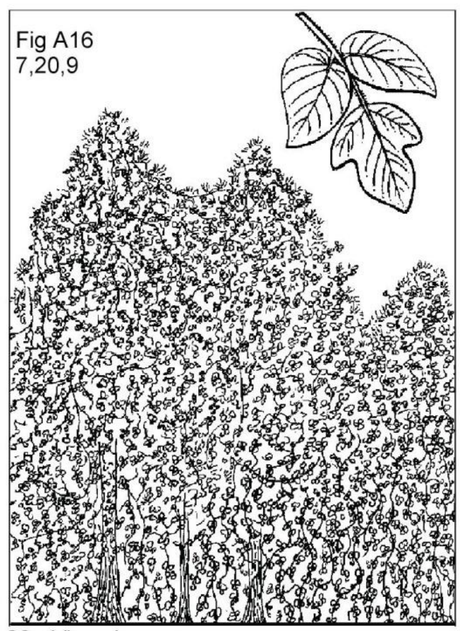
12 - Brooms on roots or bole



13 - Broken or dead roots >3' from bole

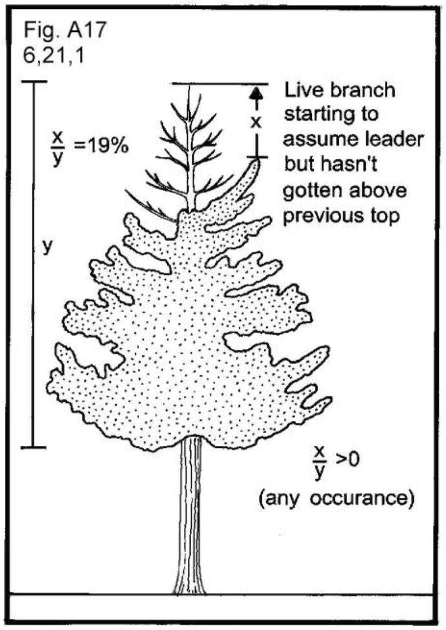


20 - Vines in crown

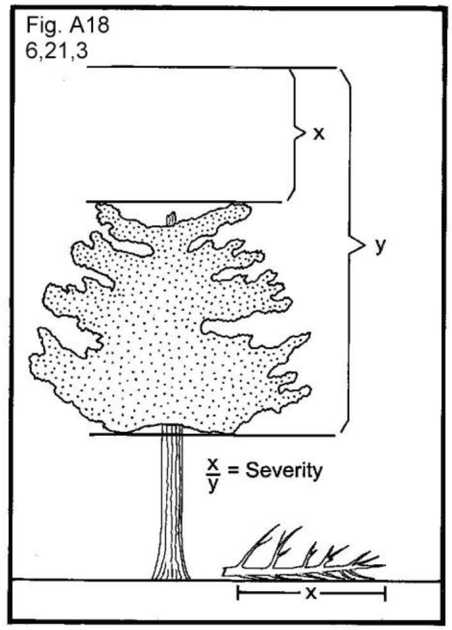


20 - Vines in crown

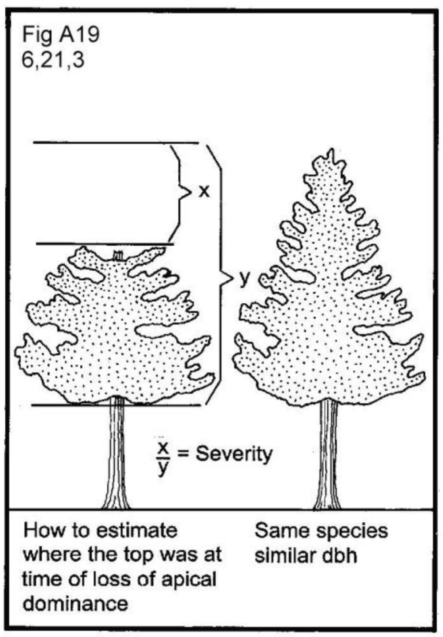
Figure 54. Examples of damage coding.



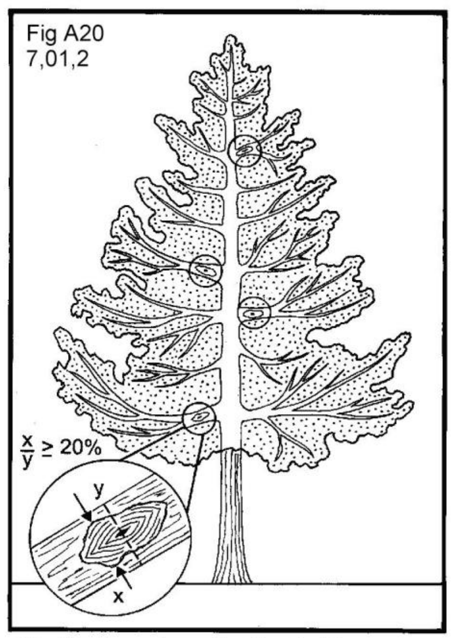
21 - Loss of apical dominance



21 - Loss of apical dominance, look for old top to estimate the top of x and y

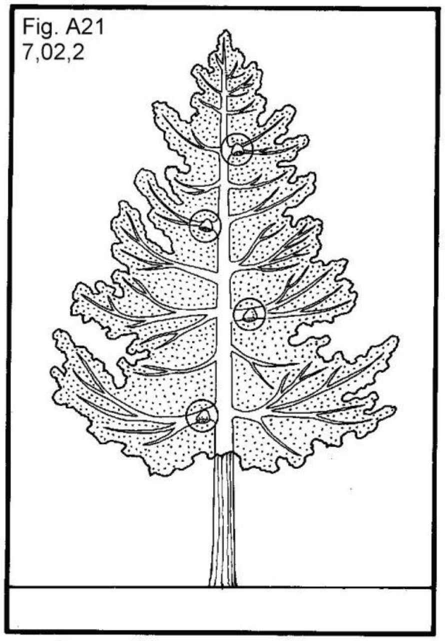


21 - Loss of apical dominance, look for same species of similar dbh

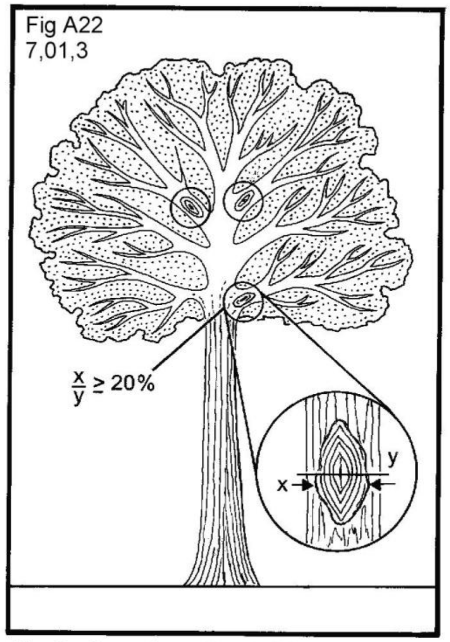


01 - Cankers above the threshold on $\geq$ 20% of branches

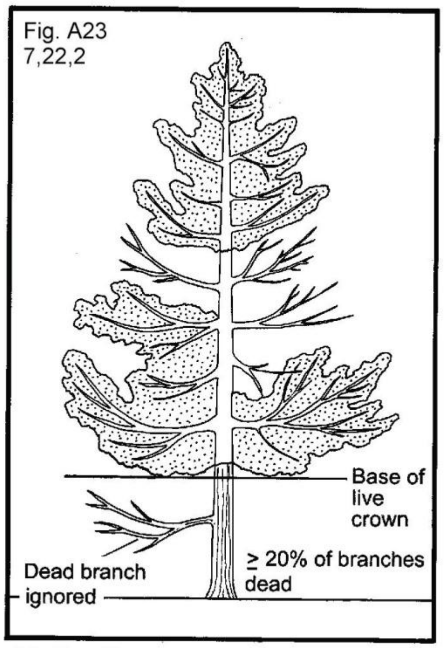
Figure 55. Examples of damage coding.



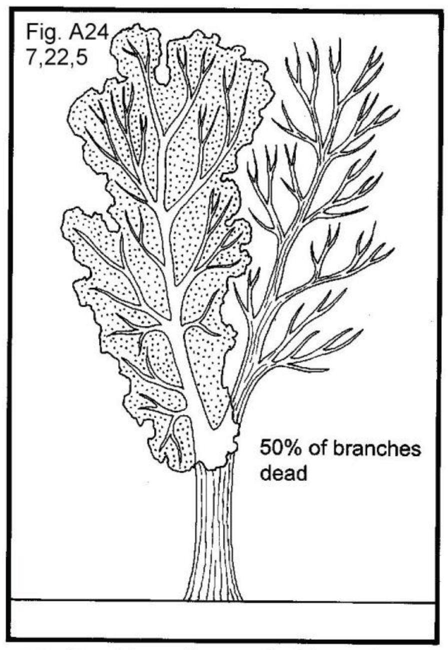
02 - Conks on ≥ 20% of branches



01 - Cankers above threshold on ≥ 20% of branches

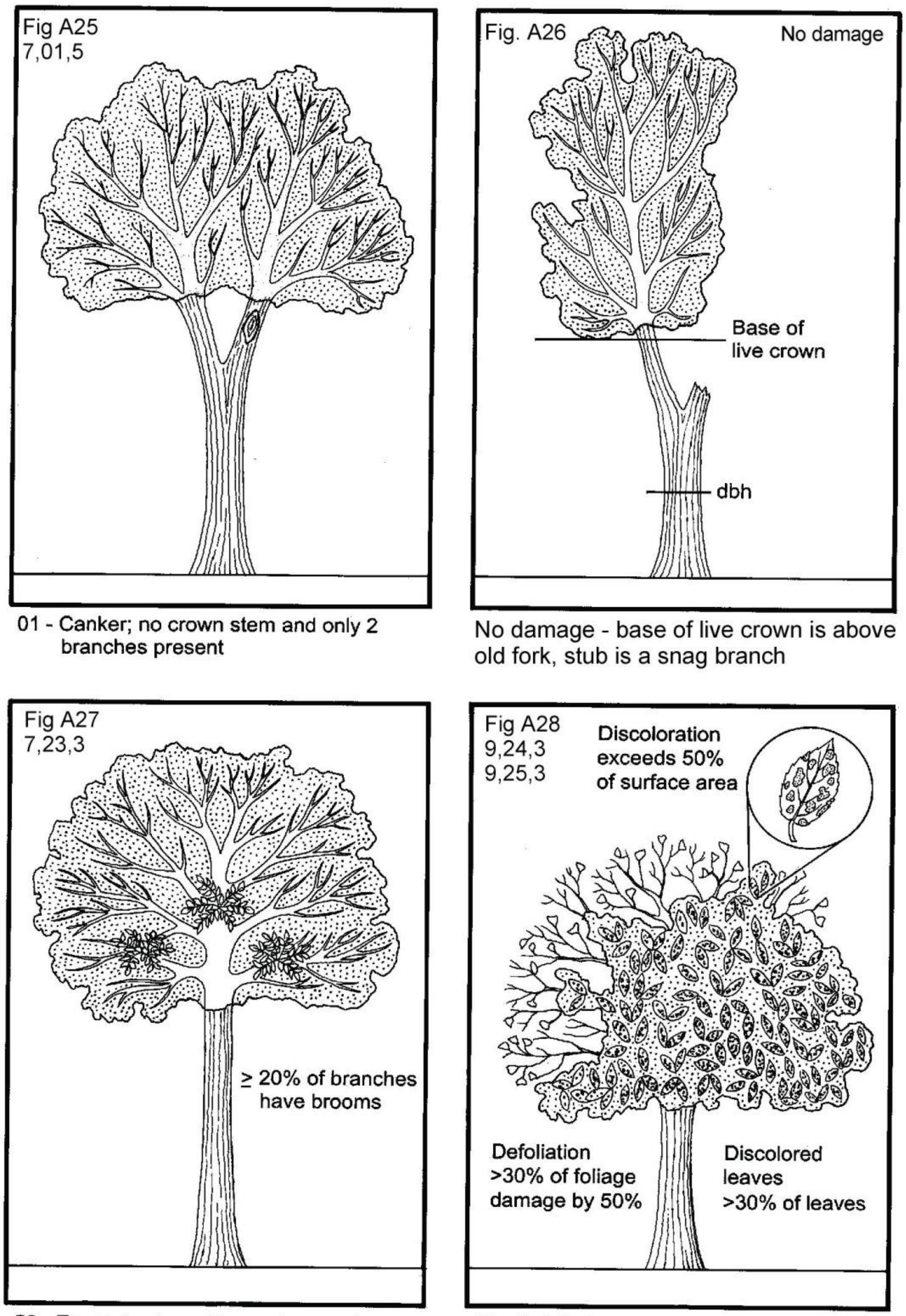


22 - Dead branches within the live crown area. If branches cannot easily be counted, estimate % area of live crown affected



22 - Dead branches; only 2 branches present within live crown area, fines present and ≥ 20% of branch dead

Figure 56. Examples of damage coding.



01 - Canker; no crown stem and only 2 branches present

No damage - base of live crown is above old fork, stub is a snag branch

23 - Excessive branching or brooms in crown

24 - Defoliation, 25 - Discoloration

Figure 57. Examples of damage coding.

Procedures to Record Multiple Occurrences of the Same Damage

Damage codes 01 (canker), 03 (open wounds), and 04 (resinosis/gummosis) must meet a threshold of 20 percent of the circumference at the point of occurrence, within any 3-foot section. Multiple cankers or open wounds which are directly above one another pose no more threat to long term tree survival than would a single damage incidence of the same width. However, should multiple damages be located horizontally within any 3-foot section, the translocation of water and nutrients would be significantly affected. The widths of each individual damage are added and compared as a percent to the total circumference at the midpoint of the 3-foot section (Figure 50).

Procedures to Measure Circumference Affected

A practical approach is to observe every face of the "stump", bole, or crownstem. About 40 percent of the circumference of a face can be observed at any one time. The damage is measured horizontally between the margins. If the cumulative area affected within a 3-foot section exceeds 1/2 of any face, then the 20 percent minimum threshold has been met. The percent of the circumference affected by damage is then estimated in 10 percent classes. If in doubt, measure the damage and circumference at the widest point of occurrence on the bole with a linear tape, and determine the percent affected.

10.25.4 DAMAGING AGENT 1 (HAWAII) [DMG_AGENT1_CD_PNWRS]

When known, record the specific name of the damaging agent (genus and species, or common name of fungal pathogens, insects, parasites…) in tree notes. **For Pig damage make sure to code 47 rather than the general animal code of 40.** If the damaging agent is unknown record 99.

When Collected: All tally trees where DAMAGE LOCATION 1 > 0
Field width: 2 digits
Tolerance: No errors
Values:

10	Insect
20	Disease
30	Fire
40	Animal
47	**Pigs, wild boars**
50	Weather
60	Vegetation (suppression, competition, vines/kudzu)
70	Unknown/not sure/other (include notes)
80	Human-caused (cultural, logging, accidental, etc.)
90	Physical (roots are undermined by erosion, hit by falling tree)
99	Unknown

10.25.5 DAMAGE LOCATION 2 (CORE 5.20.4) [DAMLOC2]

Record the location on the tree where TREE DAMAGE 2 is found. Follow the same procedures as for DAMAGE LOCATION 1.

10.25.6 DAMAGE TYPE 2 (CORE 5.20.5) [DAMTYP2]

RECORD the second damage type observed that meets the damage threshold definition in the lowest location. Describe the damage agent in tree notes. Follow the same procedures as for DAMAGE TYPE 1.

10.25.7 DAMAGE SEVERITY 2 (CORE 5.20.6) [DAMSEV2]

Record the amount of affected area (above threshold) in DAMAGE LOCATION 2 recorded for DAMAGE TYPE 2. Follow the same procedures as for DAMAGE SEVERITY 1.

10.25.8 DAMAGING AGENT 2 (HAWAII) [DMG_AGENT2_CD_PNWRS]

When known, record the specific name of the damaging agent (genus and species, or common name of fungal pathogens, insects, parasites…). If the damaging agent is unknown record 99.

10.26 DECAY CLASS (CORE 5.23) [DECAYCD]

Record for each standing dead tally tree, 5.0 inches in diameter and larger, the code indicating the trees stage of decay.

When Collected: All standing dead tally trees ≥ 5.0 in DBH
Field width: 1 digit
Tolerance: +/- 1 class
MQO: At least 90% of the time
Values: Use the following table for guidelines:

Decay class stage (code)	Limbs and branches	Top	% Bark Remaining	Sapwood presence and condition*	Heartwood condition*
1	All present	Pointed	100	Intact; sound, incipient decay, hard, original color	Sound, hard, original color
2	Few limbs, no fine branches	May be broken	Variable	Sloughing; advanced decay, fibrous, firm to soft, light brown	Sound at base, incipient decay in outer edge of upper bole, hard, light to reddish brown
3	Limb stubs only	Broken	Variable	Sloughing; fibrous, soft, light to reddish brown	Incipient decay at base, advanced decay throughout upper bole, fibrous, hard to firm, reddish brown
4	Few or no stubs	Broken	Variable	Sloughing; cubical, soft, reddish to dark brown	Advanced decay at base, sloughing from upper bole, fibrous to cubical, soft, dark reddish brown
5	None	Broken	Less than 20	Gone	Sloughing, cubical, soft, dark brown, OR fibrous, very soft, dark reddish brown, encased in hardened shell

*Characteristics are for Douglas-fir. Dead trees of other species may vary somewhat. Use this only as a guide.

10.27 EPIPHYTE LOADING (HAWAII) [EPIPHYTE_PNWRS]

Record a code indicating the extent of epiphyte loading for all live trees $\geq$ 1.0 in. d.b.h. "Epiphyte" is defined as a plant that uses a tree for support, but does not draw nourishment from it. For our purposes, vines and lianas are considered epiphytes.

Use the Hawksworth six-class rating system: divide the tree into thirds, and rate each third using the following scale.

Code	Epiphytes	Description
0	No visible epiphytes	None
1	Light epiphytes	< 50 percent of the branches or bole is loaded with epiphytes
2	Heavy epiphytes	> 50 percent of the branches or bole loaded with epiphytes

Sum the three individual ratings to obtain a total epiphyte class (0 to 6) for the tree.

Example: A tree has no loading in top third of crown, many epiphytes in the middle third, and has a few epiphytes in the lower third.

The total score is: 0 + 2 +1 = 3; the code is: "3"

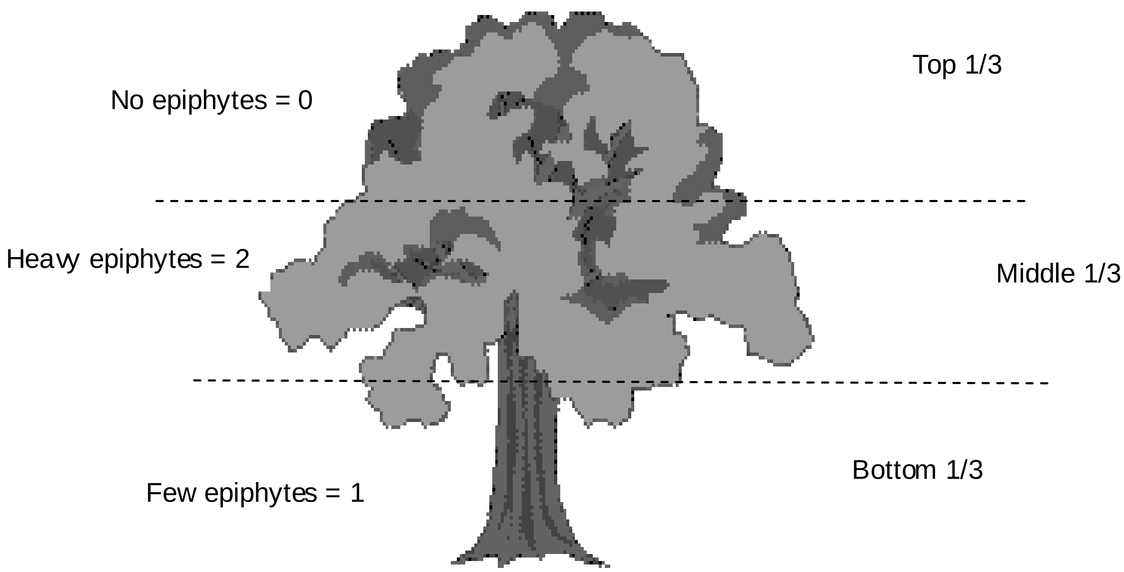


Figure 58. Example of epiphyte loading for tree crowns

When Collected: All live trees $\geq$ 1.0 in DBH.
Field width: 1 digit
Tolerance: +/- 1 class
MQO: At least 90% of the time
Values: 0 to 6.

10.28 CLUMP CODE (HAWAII) [HRDWD_CLUMP_CD]

A clump is defined as 3 or more live stems originating from a root system. Do not tally seedling-sized suckers that have sprouted from the base of a live, unsuppressed stem that is >= 5.0 in DBH.

Clump code is a 1 digit code indicating if a tree, sapling, or seedling is part of a clump. The clump of trees is assigned a clump number, and the number is recorded for each tree tallied that is part of the clump. If a tree is not part of a clump, "0" is recorded for that tree. Clumps with tallied trees are numbered in consecutive order on a subplot starting with "1".

Example: Maple trees in three different maple clumps are tallied on a subplot. Trees tallied that are in the first clump are coded "1" for clump code. Trees tallied in the second clump are all coded "2", and each tree tallied in the third clump is coded "3" for the clump code, etc, etc.

When collected: All live tally trees > 1,0 in DBH
Field width: 1 digit
Tolerance: No errors
Values: 0-9

10.29 PRIORITY DAMAGE (HAWAII) [PRIDAM_PNWRS]

Record a code to describe a damage that does not meet the national minimum thresholds for recording damage, but is of special interest in this region. For example, code any evidence of rhinoceros beetle damage on coconut trees. Record 0 if none of the specified damages are present.

When collected: All live tally trees > 1.0 in DBH
Field width: 1 digit
Tolerance: No errors
Values:

0	None of the following present
1	Rhinoceros beetle
2	Brown root rot
3	Tinangaha
4	Banana nematodes
5	Puccinia psidii
6	Pig, wild boar

10.29.1 PRIORITY DAMAGE SEVERITY (HAWAII) [PRIDAMSEV_PNWRS]

Record the amount of area affected by the PRIORITY DAMAGE when Rhinoceros beetle or Puccinia psidii are recorded for PRIORITY DAMAGE These damages have no minimum threshold.

To code DAMAGE SEVERITY for Rhinoceros beetle use the following directions:

1. Draw an imaginary horizontal line just above the coconuts (or where they should be)

2. Count the number of fronds that grow above that line
3. Count the number of fronds in #2 that have been damaged by rhinoceros beetles
4. Divide the number of damaged fronds by the number of fronds counted in # 2.
5. Multiply by 100

Record this number as the severity of rhinoceros beetle damage. If the resulting number is 100, record 99.

When collected: When PRIORITY DAMAGE = 1 (Rhinoceros beetle) or 5 (Puccinia psidii)
Field width: 2 digits
Tolerance: +/- 1
Values:

When PRIORITY DAMAGE = 1 (Rhinoceros beetle), values = 01 – 99

When PRIORITY DAMAGE = 5 (Puccinia psidii), record the highest level of severity found on the tree (highest numbered code):

1	Symptoms found, but no rust spores confirmed
2	1-5 spots, yellow or white urediniospores confirmed
3	3-7 large or about 10-15 small spots, with a moderate level of disease; yellow/white urediniospores confirmed
4	Severe disease levels; stems with pustules and/or no leaves
5	Dead apical tips and numerous defoliated tips

10.30 ROTTEN/MISSING CULL (CORE OPTIONAL 5.13) [CULL_FLD]

Record the percent rotten or missing cubic-foot cull for all live tally trees greater than or equal to 5.0 inches DBH/DRC (CORE) and all standing dead tally trees greater than or equal to 5.0 inches DBH.

Record the percentage of rotten and missing cubic-foot volume, to the nearest 1 percent. When estimating volume loss (tree cull), only consider the cull on the merchantable bole/portion of the tree, from a 1-foot stump to a 4-inch DOB top. Do not include any cull estimate above ACTUAL LENGTH.

Rotten and missing volume loss is often difficult to estimate. Refer to supplemental disease and insect pests field guides and local defect guidelines as an aid in identifying damaging agents and their impact on volume loss. Use your best judgment and be alert to such defect indicators as the following:

- Cankers or fruiting bodies.
- Swollen or punky knots.
- Dull, hollow sound of bole (use regional standards).
- Large dead limbs, especially those with frayed ends.
- Sawdust around the base of the tree.
- Metal imbedded in the wood.

When cull is coded because of rot, then a damage must also be coded.

When Collected: All live and standing dead tally trees ≥ 5.0 in DBH
Field width: 2 digits
Tolerance: +/- 10 %
MQO: At least 90% of the time
Values: 0 to 99

10.31 CAUSE OF DEATH (CORE 5.21) [AGENTCD]

Record a cause of death for all trees that have died or been cut since the previous survey. If cause of death cannot be reliably estimated, record unknown/not sure/other.

When Collected: SAMPLE KIND = 2 plots: all PREVIOUS TREE STATUS = 1 and PRESENT TREE STATUS = 2 or 3; or PRESENT TREE STATUS = 2 and RECONCILE = 1, 2, or 3

Field width: 2 digits
Tolerance: No errors
MQO: At least 80% of the time
Values:

10	Insect
20	Disease
30	Fire
40	Animal
50	Weather
60	Vegetation (suppression, competition, vines/kudzu)
70	Unknown/not sure/other - includes death from human activity not related to silvicultural or landclearing activity (accidental, random, etc.). TREE NOTES required.
80	Silvicultural or landclearing activity (death caused by harvesting or other silvicultural activity, including girdling, chaining, etc., or to landclearing activity)

10.32 TREE NOTES (CORE 5.27) [NOTES]

Record notes pertaining to an individual tree as called for to explain or describe another variable.

When collected: All trees, as needed
Field width: 2000 Characters
Tolerance: N/A
MQO: N/A
Values: English language words, phrases and numbers

APPENDIX 1 – TREE SPECIES LISTS

All Trees: ordered alphabetically

Species_Code	PLANTS_Accepted_Name	COMMON_NAME
6002	Acacia aneura	mulga
6004	Acacia confusa	small Philippine acacia
303	Acacia farnesiana	sweet acacia
6006	Acacia koa	koa
6007	Acacia koaia	koaoha
6010	Acacia mearnsii	black wattle
6011	Acacia melanoxylon	blackwood
6014	Acacia parramattensis	South Wales wattle
6016	Acacia spp.	acacia
6028	Adenanthera pavonina	red beadtree
6029	Adenanthera spp.	beadtree
341	Ailanthus altissima	tree of heaven
6051	Ailanthus spp.	ailanthus
6057	Albizia chinensis	Chinese albizia
6059	Albizia lebbeck	woman's tongue
6062	Albizia saponaria	whiteflower albizia
6063	Albizia spp.	albizia
6069	Alectryon macrococcus	Hawai'i alectryon
6070	Alectryon macrococcus var. auwahiensis	Hawai'i alectryon
6071	Alectryon macrococcus var. macrococcus	Hawai'i alectryon
6073	Alectryon spp.	alectryon
6075	Aleurites moluccana	Indian walnut
6076	Aleurites moluccana var. katoi	Indian walnut
6077	Aleurites spp.	aleurites
6086	Alnus nepalensis	Nepal alder
6087	Alnus spp.	alder
6089	Alphitonia ponderosa	Hawai'i kauilatree
6095	Alstonia macrophylla	deviltree
6097	Alstonia spp.	alstonia
6135	Antidesma kapuae	Kapua china laurel
6139	Antidesma platyphyllum	ha'a
6140	Antidesma platyphyllum var. hillebrandii	Hillebrand's ha'a
6141	Antidesma platyphyllum var. platyphyllum	ha'a
6143	Antidesma pulvinatum	hame
6145	Antidesma spp.	chinalaurel

6154	Araucaria angustifolia	parana pine
6155	Araucaria columnaris	New Caledonia pine
6159	Archontophoenix alexandrae	Alexandra palm
6161	Ardisia elliptica	shoebutton
6166	Ardisia spp.	marlberry
6171	Artocarpus altilis	breadfruit
6215	Bambusa spp.	bamboo
6216	Bambusa vulgaris	common bamboo
6226	Bauhinia monandra	Napoleon's plume
6230	Bauhinia spp.	bauhinia
6236	Bischofia javanica	Javanese bishopwood
6237	Bischofia spp.	bishopwood
6238	Bixa orellana	lipsticktree
6239	Bixa spp.	bixa
6242	Bobea brevipes	'akupa
6243	Bobea elatior	'ahakea lau nui
6244	Bobea sandwicensis	Hawai'i dogweed
6245	Bobea spp.	'ahakea
6246	Bobea timonioides	'ahakea
6247	Bocconia frutescens	parrotweed
6248	Bocconia spp.	bocconia
6260	Broussaisia arguta	kanawao
6262	Broussonetia papyrifera	paper mulberry
6264	Brugmansia candida	angel's-trumpet
6267	Bruguiera parviflora	smallflower bruguiera
6268	Bruguiera sexangula	Oriental mangrove
6269	Bruguiera spp.	bruguiera
6286	Buddleja asiatica	dogtail
6318	Caesalpinia kavaiensis	uhiuhi
6341	Calophyllum inophyllum	Alexandrian laurel
6345	Calophyllum spp.	calophyllum
6346	Calotropis procera	roostertree
6347	Calotropis spp.	calotropis
6395	Carica papaya	papaya
6396	Carica spp.	papaya
6397	Carmona retusa	scorpionbush
6398	Carmona spp.	scorpionbush
6433	Casuarina cunninghamiana	river sheoak
6434	Casuarina equisetifolia	beach sheoak
856	Casuarina glauca	gray sheoak
6438	Casuarina spp.	sheoak
6441	Cecropia obtusifolia	trumpet tree
6444	Cecropia spp.	pumpwood

6469	Cereus hildmannianus	hedge cactus
6470	Cereus spp.	sweetpotato cactus
6473	Cestrum aurantiacum	orange jessamine
6474	Cestrum diurnum	day jessamine
6477	Cestrum nocturnum	night jessamine
6478	Cestrum spp.	jessamine
6482	Chamaesyce atrococca	koko
6483	Chamaesyce celastroides	'ekoko
6484	Chamaesyce celastroides var. amplectens	'ekoko
6485	Chamaesyce celastroides var. celastroides	'ekoko
6486	Chamaesyce celastroides var. hanapepensis	'ekoko
6487	Chamaesyce celastroides var. kaenana	'ekoko
6488	Chamaesyce celastroides var. laehiensis	'ekoko
6489	Chamaesyce celastroides var. lorifolia	'ekoko
6490	Chamaesyce celastroides var. stokesii	'ekoko
6491	Chamaesyce celastroides var. tomentella	'ekoko
6492	Chamaesyce herbstii	Herbst's sandmat
6493	Chamaesyce kuwaleana	kokomalei
6494	Chamaesyce olowaluana	alpine sandmat
6495	Chamaesyce rockii	Koolau Range sandmat
6496	Chamaesyce spp.	sandmat
6497	Charpentiera densiflora	Napali coast papala
6498	Charpentiera elliptica	ellipticleaf papala
6499	Charpentiera obovata	broadleaf papala
6500	Charpentiera ovata	Koolau Range papala
6501	Charpentiera ovata var. niuensis	Koolau Range papala
6502	Charpentiera ovata var. ovata	Koolau Range papala
6503	Charpentiera spp.	papala
6504	Charpentiera tomentosa	Waianae Range papala
6505	Charpentiera tomentosa var. maakuaensis	Waianae Range papala
6506	Charpentiera tomentosa var. tomentosa	Waianae Range papala

6507	Cheirodendron dominii	Domin's club
6508	Cheirodendron fauriei	Faurie's club
6509	Cheirodendron forbesii	olapa
6510	Cheirodendron platyphyllum	lapalapa
6511	Cheirodendron platyphyllum ssp. kauaiense	lapalapa
6512	Cheirodendron platyphyllum ssp. platyphyllum	lapalapa
6513	Cheirodendron spp.	cheirodendron
6514	Cheirodendron trigynum	olapalapa
6515	Cheirodendron trigynum ssp. helleri	olapalapa
6516	Cheirodendron trigynum ssp. trigynum	olapalapa
6517	Chenopodium oahuense	alaweo
6518	Chenopodium spp.	goosefoot
6542	Chrysophyllum oliviforme	satinleaf
6546	Cibotium chamissoi	Chamisso's manfern
6547	Cibotium glaucum	hapu'u
6545	Cibotium heleniae	Hāpu'u, Hawaiian tree fern
6548	Cibotium menziesii	hapu'u li
6549	Cibotium spp.	manfern
6552	Cinchona pubescens	quinine
6553	Cinchona spp.	cinchona
6555	Cinnamomum burmannii	Padang cassia
858	Cinnamomum camphora	camphortree
6563	Cinnamomum spp.	cinnamon
6564	Cinnamomum verum	cinnamon
6565	Citharexylum caudatum	juniper berry
6567	Citharexylum spinosum	spiny fiddlewood
6568	Citharexylum spp.	fiddlewood
6591	Claoxylon sandwicense	po'ola
6592	Claoxylon spp.	claoxylon
6597	Clermontia arborescens	'oha wai nui
6598	Clermontia arborescens ssp. arborescens	'oha wai nui
6599	Clermontia arborescens ssp. waihiae	'oha wai nui
6600	Clermontia arborescens ssp. waikoluensis	oha wai nui, Clermontia
6601	Clermontia clermontioides	Kauai clermontia
6602	Clermontia clermontioides ssp. clermontioides	Kauai clermontia

6603	Clermontia clermontioides ssp. rockiana	Kauai clermontia
6604	Clermontia drepanomorpha	Kohala Mountain clermontia
6605	Clermontia fauriei	haha'aiakamanu
6606	Clermontia grandiflora	bog clermontia
6607	Clermontia grandiflora ssp. grandiflora	bog clermontia
6608	Clermontia grandiflora ssp. maxima	oha wai nui, Clermontia
6609	Clermontia grandiflora ssp. munroi	bog clermontia
6610	Clermontia hawaiiensis	'oha kepau
6611	Clermontia kakeana	forest clermontia
6612	Clermontia kohalae	Waipio Valley clermontia
6596	Clermontia leptoclada	oha wai nui, Clermontia
6613	Clermontia lindseyana	hillside clermontia
6614	Clermontia micrantha	Maui clermontia
6615	Clermontia montis-loa	Mauna Loa clermontia
6616	Clermontia oblongifolia	Oahu clermontia
6617	Clermontia oblongifolia ssp. brevipes	Oahu clermontia
6618	Clermontia oblongifolia ssp. mauiensis	Oahu clermontia
6619	Clermontia oblongifolia ssp. oblongifolia	Oahu clermontia
6620	Clermontia pallida	Wailai Pali clermontia
6621	Clermontia parviflora	smallflower clermontia
6622	Clermontia peleana	pele clermontia
6625	Clermontia persicifolia	Waioiani clermontia
6626	Clermontia pyrularia	Hamakua clermontia
6628	Clermontia spp.	clermontia
6629	Clermontia tuberculata	Haleakala clermontia
6630	Clermontia waimeae	swampforest clermontia
6632	Clerodendrum chinense	stickbush
6633	Clerodendrum glabrum	Natal glorybower
6634	Clerodendrum indicum	turk's turbin
6635	Clerodendrum macrostegium	velvetleaf glorybower
6636	Clerodendrum spp.	glorybower
6651	Clusia rosea	scotch attorney
6652	Clusia spp.	attorney

6670	Coccoloba uvifera	seagrape
908	Cocos nucifera	coconut palm
6681	Cocos spp.	coconut palm
6684	Coffea arabica	Arabian coffee
6687	Coffea spp.	coffee
6694	Colubrina asiatica	Asian nakedwood
6697	Colubrina oppositifolia	kauila
6699	Colubrina spp.	nakedwood
987	Conocarpus erectus	button mangrove
6709	Conocarpus spp.	mangrove
6716	Coprosma foliosa	forest mirrorplant
6717	Coprosma kauensis	koi
6718	Coprosma longifolia	Oahu mirrorplant
6719	Coprosma montana	alpine mirrorplant
6720	Coprosma ochracea	Maui mirrorplant
6721	Coprosma pubens	pubescent mirrorplant
6722	Coprosma rhynchocarpa	woodland mirrorplant
6724	Coprosma spp.	mirrorplant
6726	Coprosma waimeae	'olena
6731	Cordia collococca	red manjack
6733	Cordia dichotoma	fragrant manjack
6741	Cordia spp.	cordia
6742	Cordia subcordata	kou
6744	Cordyline fruticosa	tiplant
6745	Cordyline spp.	cordyline
6749	Corymbia calophylla	redgum
6750	Corymbia citriodora	lemonscented gum
6751	Corymbia ficifolia	redflower gum
6752	Corymbia gummifera	red bloodwood
6754	Corynocarpus laevigatus	karaka nut
6755	Corynocarpus spp.	corynocarpus
6771	Crotalaria longirostrata	longbeak rattlebox
6781	Cryptocarya mannii	holio
6783	Cryptocarya spp.	cryptocarya
6787	Cryptomeria spp.	Japanese cedar
6795	Cupressus lusitanica	cedar-of-Goa
6796	Cupressus sempervirens	Italian cypress
6797	Cupressus spp.	cypress
6800	Cyanea aculeatiflora	Haleakala cyanea
6801	Cyanea arborea	palmtree cyanea
6802	Cyanea fissa	Kauai cyanea
6803	Cyanea fissa ssp. fissa	Kauai cyanea
6804	Cyanea fissa ssp. gayana	Kauai cyanea

6805	Cyanea floribunda	Degener's cyanea
6806	Cyanea giffardii	Kilauea Mauna cyanea
6807	Cyanea hamatiflora	wetforest cyanea
6808	Cyanea hamatiflora ssp. carlsonii	Carlson's cyanea
6809	Cyanea hamatiflora ssp. hamatiflora	wetforest cyanea
6810	Cyanea hardyi	Oahu cyanea
6811	Cyanea horrida	prickly cyanea
6812	Cyanea kuhihewa	Limahuli Valley cyanea
6813	Cyanea kunthiana	Kunth's cyanea
6814	Cyanea leptostegia	giant kokee cyanea
6815	Cyanea macrostegia	purple cyanea
6816	Cyanea macrostegia ssp. gibsonii	Gibson's cyanea
6817	Cyanea macrostegia ssp. macrostegia	purple cyanea
6818	Cyanea marksii	Marks' cyanea
6819	Cyanea pilosa	hairy cyanea
6820	Cyanea pilosa ssp. longipedunculata	hairy cyanea
6821	Cyanea pilosa ssp. pilosa	hairy cyanea
6822	Cyanea pohaku	pohaku cyanea
6823	Cyanea procera	Molokai cyanea
6824	Cyanea pycnocarpa	manyfruit cyanea
6825	Cyanea quercifolia	oakleaf cyanea
6826	Cyanea rivularis	plateau delissea
6827	Cyanea solenocalyx	pua kala
6828	Cyanea spp.	cyanea
6829	Cyanea stictophylla	Kaiholena cyanea
6830	Cyanea superba	Mt. Kaala cyanea
6831	Cyanea superba ssp. regina	Mt. Kaala cyanea
6832	Cyanea superba ssp. superba	Mt. Kaala cyanea
6833	Cyanea tritomantha	'aku 'aku
6837	Cyathea cooperi	Cooper's cyathea
6847	Cyathea spp.	treefern
6865	Cyrtandra giffardii	forest cyrtandra
6864	Cyrtandra ramosissima	Cyrtandra
6866	Cyrtandra spp.	cyrtandra
6875	Delissea fallax	Hawai'i delissea
6876	Delissea laciniata	cutleaf delissea
6877	Delissea niihauensis	Niihau delissea

6878	Delissea niihauensis ssp. kauaiensis	leechleaf delissea
6879	Delissea niihauensis ssp. niihauensis	Niihau delissea
6880	Delissea parviflora	smallflower delissea
6881	Delissea spp.	delissea
6882	Delissea undulata	leechleaf delissea
6883	Delonix regia	royal poinciana
6884	Delonix spp.	delonix
6898	Dillenia suffruticosa	shrubby dillenia
6900	Diospyros blancoi	mabolo
6906	Diospyros hillebrandii	elama
6911	Diospyros sandwicensis	lama
6913	Diospyros spp.	diospyros
6930	Dovyalis hebecarpa	Ceylon gooseberry
6947	Dubautia arborea	Mauna Kea dubautia
6944	Dubautia demissifolia	Dubautia
6945	Dubautia fallax	Dubautia
6948	Dubautia knudsenii	forest dubautia
6949	Dubautia knudsenii ssp. filiformis	forest dubautia
6950	Dubautia knudsenii ssp. knudsenii	forest dubautia
6951	Dubautia knudsenii ssp. nagatae	forest dubautia
6952	Dubautia microcephala	Kauai dubautia
6946	Dubautia montana	Dubautia
6953	Dubautia plantaginea	plantainleaf dubautia
6954	Dubautia plantaginea ssp. humilis	plantainleaf dubautia
6955	Dubautia plantaginea ssp. magnifolia	plantainleaf dubautia
6956	Dubautia plantaginea ssp. plantaginea	plantainleaf dubautia
6957	Dubautia reticulata	netvein dubautia
6958	Dubautia spp.	dubautia
6961	Duranta erecta	golden dewdrops
6975	Elaeocarpus bifidus	kalia
6996	Enterolobium cyclocarpum	monkeysoap
6998	Eriobotrya japonica	loquat
6999	Eriobotrya spp.	loquat
7012	Erythrina sandwicensis	wili wili
7013	Erythrina spp.	erythrina
7015	Erythrina variegata	tiger's claw

7025	Eucalyptus botryoides	southern mahogany
7026	Eucalyptus bridgesiana	applebox
512	Eucalyptus camaldulensis	river redgum
7028	Eucalyptus cinerea	argyle apple
7030	Eucalyptus cladocalyx	sugargum
7031	Eucalyptus cornuta	yate
7032	Eucalyptus crebra	narrowleaf red ironbark
7033	Eucalyptus deanei	roundleaf gum
7034	Eucalyptus deglupta	Indonesian gum
511	Eucalyptus globulus	Tasmanian bluegum
7036	Eucalyptus globulus ssp. globulus	Tasmanian bluegum
7037	Eucalyptus globulus ssp. Maidenii	Tasmanian bluegum
7038	Eucalyptus gomphocephala	tuart
7039	Eucalyptus goniocalyx	mountain graygum
513	Eucalyptus grandis	grand eucalyptus
7041	Eucalyptus hemiphloia	white box
7042	Eucalyptus hemiphloia var. albens	whitebox
7044	Eucalyptus marginata	jarrah
7045	Eucalyptus microcorys	Australian tallowwood
7046	Eucalyptus paniculata	gray ironbark
7047	Eucalyptus pilularis	blackbutt
7048	Eucalyptus raveretiana	black ironbox
7049	Eucalyptus resinifera	redmahogany
514	Eucalyptus robusta	swampmahogany
7051	Eucalyptus rudis	Western Australian floodedgum
7052	Eucalyptus salicifolia	black peppermint
7053	Eucalyptus saligna	Sydney bluegum
7054	Eucalyptus sideroxylon	red ironbark
7055	Eucalyptus spp.	gum
7056	Eucalyptus tereticornis	forest redgum
7057	Eucalyptus viminalis	manna gum
7079	Eugenia koolauensis	nioi
7091	Eugenia reinwardtiana	mountain stopper
7096	Eugenia spp.	stopper
7104	Eugenia uniflora	Surinam cherry
7110	Euphorbia haeleeleana	Kauai spurge
7114	Euphorbia pulcherrima	poinsettia
7115	Euphorbia spp.	spurge
7116	Euphorbia tirucalli	Indiantree spurge

7119	Eurya sandwicensis	anini
7120	Eurya spp.	eurya
7131	Exocarpos gaudichaudii	hulumoa
7132	Exocarpos spp.	exocarpos
7144	Falcataria moluccana	peacocksplume
7145	Falcataria spp.	peacocksplume
7160	Ficus microcarpa	Chinese banyan
7162	Ficus nota	tibig
7167	Ficus rubiginosa	Port Jackson fig
7171	Ficus spp.	fig
7175	Ficus thonningii	Chinese banyan
7182	Fitchia speciosa	burrdaisytree
7188	Flindersia brayleyana	Queensland maple
7192	Flueggea neowawraea	mehamehame
7193	Flueggea spp.	bushweed
7200	Frangula californica	California buckthorn
7201	Frangula californica ssp. californica	California buckthorn
541	Fraxinus americana	white ash
7206	Fraxinus uhdei	shamel ash
7207	Fuchsia boliviana	Bolivian fuchsia
7208	Fuchsia paniculata	shrubby fuchsia
7209	Fuchsia spp.	fuchsia
7224	Gardenia brighamii	forest gardenia
7225	Gardenia mannii	Oahu gardenia
7226	Gardenia remyi	Remy's gardenia
7227	Gardenia spp.	gardenia
7228	Gardenia taitensis	Tahitian gardenia
7262	Gossypium barbadense	Creole cotton
7263	Gossypium hirsutum	upland cotton
7264	Gossypium hirsutum var. hirsutum	upland cotton
7272	Grevillea banksii	kahiliflower
7273	Grevillea robusta	silkoak
7274	Grevillea spp.	grevillea
7321	Haematoxylum campechianum	bloodwoodtree
7343	Hedyotis fosbergii	Fosberg's starviolet
7344	Hedyotis hillebrandii	manono
7345	Hedyotis spp.	starviolet
7346	Hedyotis terminalis	variable starviolet
7349	Heliocarpus popayanensis	white moho
7350	Heliocarpus spp.	heliocarpus
7370	Hesperomannia arborescens	Lanai island-aster

7371	Hesperomannia arbuscula	Maui island-aster
7372	Hesperomannia lydgatei	Kauai island-aster
7373	Hesperomannia spp.	island-aster
7374	Heteromeles arbutifolia	toyon
7375	Heteromeles arbutifolia var. arbutifolia	toyon
7376	Heteromeles spp.	toyon
7384	Hibiscadelphus bombycinus	hau kuahiwi
7385	Hibiscadelphus crucibracteatus	lava hau kuahiwi
7386	Hibiscadelphus distans	Kauai hau kuahiwi
7387	Hibiscadelphus giffardianus	Kilauea hau kuahiwi
7388	Hibiscadelphus hualalaiensis	Hualalai hau kuahiwi
7383	Hibiscadelphus puakuahiwi	hau kuahiwi
7390	Hibiscadelphus spp.	hibiscadelphus
7391	Hibiscadelphus wilderianus	Maui hau kuahiwi
7392	Hibiscadelphus woodii	Wood's hau kuahiwi
7393	Hibiscus arnottianus	white rosemallow
7394	Hibiscus arnottianus ssp. arnottianus	white rosemallow
7395	Hibiscus arnottianus ssp. immaculatus	white rosemallow
7396	Hibiscus arnottianus ssp. punaluuensis	punaluu rosemallow
7397	Hibiscus brackenridgei	Brackenridge's rosemallow
7398	Hibiscus brackenridgei ssp. brackenridgei	Brackenridge's rosemallow
7399	Hibiscus brackenridgei ssp. mokuleianus	Mokulei rosemallow
7400	Hibiscus brackenridgei ssp. molokaianus	ma'o hau hele
7401	Hibiscus calyphyllus	lemonyellow rosemallow
7402	Hibiscus clayi	red Kauai rosemallow
7403	Hibiscus elatus	mahoe
7404	Hibiscus kokio	red rosemallow
7405	Hibiscus kokio ssp. kokio	red rosemallow
7406	Hibiscus kokio ssp. saintjohnianus	St. John's rosemallow
7407	Hibiscus macrophyllus	largeleaf rosemallow
7408	Hibiscus mutabilis	Dixie rosemallow
7411	Hibiscus spp.	rosemallow
7412	Hibiscus tiliaceus	sea hibiscus

7413	Hibiscus waimeae	white Kauai rosemallow
7414	Hibiscus waimeae ssp. hannerae	white Kauai rosemallow
7415	Hibiscus waimeae ssp. waimeae	white Kauai rosemallow
7440	Hylocereus spp.	nightblooming cactus
7441	Hylocereus undatus	nightblooming cactus
7448	Hypericum canariense	Canary Island St. Johnswort
7453	Ilex anomala	Hawai'i holly
7454	Ilex aquifolium	English holly
7460	Ilex paraguariensis	mate
7464	Ilex spp.	holly
7482	Jacaranda mimosifolia	black poui
7483	Jacaranda spp.	jacaranda
7491	Jatropha curcas	Barbados nut
7494	Jatropha spp.	nettlespurge
7509	Kokia cookei	Molokai treecotton
7510	Kokia drynarioides	Hawai'i treecotton
7511	Kokia kauaiensis	Kauai treecotton
7512	Kokia lanceolata	Wailupe Valley treecotton
7513	Kokia spp.	treecotton
7516	Kunzea ericoides	burgan
7517	Kunzea spp.	Kunzea
7518	Labordia fagraeoidea	summit labordia
7519	Labordia hedyosmifolia	bog labordia
7520	Labordia hirtella	mountain labordia
7521	Labordia kaalae	Waianae Range labordia
7522	Labordia lydgatei	Wahiawa Mountain labordia
7523	Labordia spp.	labordia
7524	Labordia tinifolia	paleflower labordia
7525	Labordia tinifolia var. lanaiensis	Lanai labordia
7526	Labordia tinifolia var. tinifolia	paleflower labordia
7527	Labordia tinifolia var. wahiawaensis	Wahiawa labordia
7528	Labordia triflora	Lanai labordia
7529	Labordia waiolani	Nevada peavine
7558	Leptospermum morrisonii	large-leaf yellow teatree

7559	Leptospermum petersonii	common teatree
7560	Leptospermum polygalifolim	common teatree
7561	Leptospermum scoparium	broom teatree
7562	Leptospermum spp.	teatree
7565	Leucaena leucocephala	white leadtree
7566	Leucaena spp.	leadtree
7575	Ligustrum sinense	Chinese privet
7576	Ligustrum spp.	privet
7588	Livistona chinensis	fountain palm
7595	Lophostemon confertus	vinegartree
7621	Macaranga mappa	pengua
7623	Macaranga spp.	macaranga
7626	Macaranga tanarius	parasol leaf tree
7639	Mallotus philippensis	kamala tree
7641	Mallotus spp.	mallotus
885	Mangifera indica	mango
7659	Mangifera spp.	mango
7660	Manihot glaziovii	ceara rubbertree
7661	Manihot spp.	manihot
992	Melaleuca quinquenervia	punktree
7709	Melaleuca spp.	melaleuca
993	Melia azedarach	Chinaberrytree
7716	Melia spp.	melia
7719	Melicope anisata	mokihana
7720	Melicope balloui	Ballou's melicope
7721	Melicope barbigera	uahiapele
7722	Melicope christophersenii	Waianae Range melicope
7723	Melicope cinerea	manena
7724	Melicope clusiifolia	kukaemoa
7725	Melicope cruciata	pilo 'ula
7726	Melicope elliptica	leiohi'iaka
7727	Melicope haleakalae	Haleakala melicope
7728	Melicope haupuensis	Haupa Mountain melicope
7729	Melicope hawaiensis	mokihana kukae moa
7730	Melicope hiiakae	Monoa melicope
7731	Melicope hosakae	Honolulu melicope
7732	Melicope kaalaensis	Kaala melicope
7733	Melicope knudsenii	Olokele Valley melicope
7734	Melicope macropus	Kaholuamanu melicope

7735	Melicope makahae	Makaha Valley melicope
7736	Melicope molokaiensis	Molokai melicope
7737	Melicope mucronulata	alani
7738	Melicope oahuensis	Oahu melicope
7739	Melicope obovata	Makawao melicope
7740	Melicope orbicularis	Honokahua melicope
7741	Melicope ovalis	Hana melicope
7742	Melicope ovata	eggshape melicope
7743	Melicope pallida	pale melicope
7744	Melicope paniculata	Lihue melicope
7745	Melicope peduncularis	boxfruit alani
7746	Melicope pseudoanisata	Kohala Summit melicope
7747	Melicope puberula	hairy melicope
7748	Melicope quadrangularis	fourangle melicope
7749	Melicope radiata	kapu melicope
7751	Melicope rotundifolia	roundleaf melicope
7752	Melicope saint-johnii	St. John's melicope
7753	Melicope sandwicensis	Mt. Kaala melicope
7754	Melicope spp.	melicope
7755	Melicope volcanica	volcanic melicope
7756	Melicope waialealae	alani wai
7757	Melicope wawraeana	Monoa melicope
7758	Melicope zahlbruckneri	kipuka piaula
7767	Melochia spp.	melochia
7769	Melochia umbellata	hierba del soldado
7782	Metrosideros macropus	'ohi'a
7783	Metrosideros polymorpha	'ohi'a lehua
7784	Metrosideros polymorpha var. dieteri	'ohi'a lehua
7785	Metrosideros polymorpha var. glaberrima	'ohi'a lehua
7786	Metrosideros polymorpha var. incana	'ohi'a lehua
7787	Metrosideros polymorpha var. macrophylla	'ohi'a lehua
7788	Metrosideros polymorpha var. newellii	'ohi'a lehua
7789	Metrosideros polymorpha var. polymorpha	'ohi'a lehua
7790	Metrosideros polymorpha var. pseudorugosa	'ohi'a lehua

7791	Metrosideros polymorpha var. pumila	'ohi'a lehua
7792	Metrosideros rugosa	lehua papa
7793	Metrosideros spp.	lehua
7794	Metrosideros tremuloides	lehua 'ahihi
7795	Metrosideros waialealae	Kauai bottlebrush
7796	Metrosideros waialealae var. fauriei	Kauai bottlebrush
7797	Metrosideros waialealae var. waialealae	Kauai bottlebrush
7805	Miconia calvescens	velvet tree
7841	Montanoa hibiscifolia	treedaisy
7842	Montanoa spp.	montanoa
7845	Morella cerifera	wax myrtle
7846	Morella faya	firetree
7848	Morella spp.	bayberry
7849	Morinda citrifolia	Indian mulberry
7852	Morinda spp.	morinda
7853	Morinda trimera	noni kuahiwi
681	Morus alba	white mulberry
7865	Munroidendron racemosum	false 'ohe
7867	Muntingia calabura	strawberrytree
7868	Muntingia spp.	muntingia
7872	Musa paradisiaca	French plantain
7879	Musa troglodytarum	fe'i banana
7883	Myoporum sandwicense	naio
7884	Myoporum spp.	myoporum
7892	Myrcia spp.	rodwood
7900	Myrica spp.	sweetgale
7910	Myrsine alyxifolia	forest colicwood
7913	Myrsine degeneri	summit colicwood
7914	Myrsine emarginata	mountain colicwood
7915	Myrsine fernseei	streambank colicwood
7916	Myrsine fosbergii	Koolau Range colicwood
7918	Myrsine helleri	Wahiawa Bog colicwood
7919	Myrsine kauaiensis	Kauai colicwood
7920	Myrsine knudsenii	Kokee colicwood
7921	Myrsine lanaiensis	Lanai colicwood
7922	Myrsine lessertiana	kolea lau nui
7923	Myrsine mezii	Hanapepe River colicwood
7924	Myrsine petiolata	swamp colicwood

7925	Myrsine pukooensis	Molokai colicwood
7926	Myrsine sandwicensis	kokea lau li'i
7927	Myrsine spp.	colicwood
7928	Myrsine wawraea	Mt. Kahili colicwood
7954	Neraudia melastomifolia	ma'aloa
7958	Nesoluma polynesicum	keahi
7960	Nestegis sandwicensis	Hawai'i olive
7961	Nestegis spp.	nestegis
7964	Nicotiana glauca	tree tobacco
7965	Nicotiana spp.	tobacco
7966	Nothocestrum breviflorum	smallflower aiea
7967	Nothocestrum latifolium	broadleaf aiea
7968	Nothocestrum longifolium	longleaf aiea
7969	Nothocestrum peltatum	Oahu aiea
7970	Nothocestrum spp.	aiea
7971	Nototrichium humile	kaala rockwort
7972	Nototrichium sandwicense	Hawai'i rockwort
7977	Ochna spp.	ochna
7978	Ochna thomasiana	Thomas' bird's-eye bush
7982	Ochrosia compta	holei
7983	Ochrosia haleakalae	island yellowwood
7984	Ochrosia kauaiensis	Kauai yellowwood
7985	Ochrosia kilaueaensis	Hawai'i yellowwood
7986	Ochrosia spp.	yellowwood
8004	Olea europaea	olive
8005	Olea europaea ssp. cuspidata	African olive
8006	Olea europaea ssp. europaea	European olive
8007	Olea spp.	olive
8013	Opuntia cochenillifera	cochineal nopal cactus
8014	Opuntia ficus-indica	tuna cactus
8015	Opuntia monacantha	common pricklypear
8018	Opuntia spp.	pricklypear
8084	Pandanus spp.	screwpine
8085	Pandanus tectorius	Tahitian screwpine
8111	Parkinsonia aculeata	Jerusalem thorn
8112	Parkinsonia spp.	paloverde
8131	Perrottetia sandwicensis	olomea
7211	Persea americana	avocado
8137	Persea spp.	bay
8152	Phoenix dactylifera	date palm
8153	Phoenix spp.	date palm

8155	Photinia davidiana	Chinese photinia
8159	Phyllanthus distichus	pamakani mahu
8175	Pimenta dioica	allspice
8183	Pinus caribaea	Caribbean pine
8187	Pinus patula	Mexican weeping pine
8188	Pinus pinaster	maritime pine
8189	Pinus spp.	pine
8205	Pipturus albidus	Waimea pipturus
8207	Pipturus spp.	pipturus
887	Piscidia piscipula	Florida fishpoison tree
8210	Piscidia spp.	piscidia
8212	Pisonia brunoniana	Australasian catchbirdtree
8213	Pisonia grandis	grand devil's-claws
8214	Pisonia sandwicensis	aulu
8215	Pisonia spp.	catchbirdtree
8217	Pisonia umbellifera	umbrella catchbirdtree
8218	Pisonia wagneriana	Kauai catchbirdtree
8220	Pithecellobium dulce	monkeypod
8226	Pittosporum argentifolium	Hawai'i poisonberry tree
8227	Pittosporum confertiflorum	ho'awa
8228	Pittosporum flocculosum	Waianae Range cheesewood
8229	Pittosporum gayanum	Waialeale cheesewood
8230	Pittosporum glabrum	Koolau Range cheesewood
8231	Pittosporum halophilum	ho'awa
8232	Pittosporum hawaiiense	Hawai'i cheesewood
8233	Pittosporum hosmeri	Kona cheesewood
8234	Pittosporum kauaiense	Kauai cheesewood
8224	Pittosporum monae	Mona cheesewood, Pittosporum
8235	Pittosporum napaliense	royal cheesewood
8236	Pittosporum pentandrum	Taiwanese cheesewood
8238	Pittosporum spp.	cheesewood
8239	Pittosporum terminalioides	cream cheesewood
8240	Pittosporum undulatum	Australian cheesewood
8241	Pittosporum viridiflorum	cape cheesewood
8250	Platydesma remyi	Hawai'i pilo kea
8251	Platydesma spathulata	Maui pilo kea

8252	Platydesma spp.	platydesma
8257	Pleomele aurea	golden hala pepe
8258	Pleomele auwahiensis	Maui hala pepe
8259	Pleomele fernaldii	Lanai hala pepe
8260	Pleomele forbesii	Waianae Range hala pepe
8261	Pleomele halapepe	royal hala pepe
8262	Pleomele hawaiiensis	Hawai'i hala pepe
8263	Pleomele spp.	hala pepe
8304	Pouteria sandwicensis	'ala'a
8306	Pouteria spp.	pouteria
8315	Pritchardia affinis	Hawai'i pritchardia
8316	Pritchardia arecina	Maui pritchardia
8317	Pritchardia beccariana	Kilauea pritchardia
8318	Pritchardia forbesiana	Mt. Eke pritchardia
8319	Pritchardia hardyi	Makaleha pritchardia
8320	Pritchardia hillebrandii	lo'ulu lelo
8321	Pritchardia kaalae	Waianae Range pritchardia
8322	Pritchardia lanaiensis	Lanai pritchardia
8323	Pritchardia lanigera	lo'ulu
8324	Pritchardia limahuliensis	Limahuli Valley pritchardia
8325	Pritchardia lowreyana	Molokai pritchardia
8326	Pritchardia martii	Koolau Range pritchardia
8327	Pritchardia minor	Alakai Swamp pritchardia
8328	Pritchardia munroi	Kamalo pritchardia
8330	Pritchardia perlmanii	Wai'oli Valley pritchardia
8331	Pritchardia remota	Nihoa pritchardia
8332	Pritchardia remota ssp. aylmer-robinsonii	Nihoa pritchardia
8333	Pritchardia remota ssp. glabrata	Nihoa pritchardia
8334	Pritchardia remota ssp. napaliensis	Nihoa pritchardia
8335	Pritchardia remota ssp. remota	Nihoa pritchardia
8336	Pritchardia schattaueri	lands of papa pritchardia
8337	Pritchardia spp.	pritchardia
8338	Pritchardia viscosa	stickybud pritchardia

8339	Pritchardia waialealeana	poleline pritchardia
8343	Prosopis juliflora	mesquite
8344	Prosopis pallida	kiawe
8345	Prosopis spp.	mesquite
8355	Psidium cattleianum	strawberry guava
8356	Psidium guajava	guava
8365	Psychotria fauriei	Koolau Range wild coffee
8366	Psychotria grandiflora	largeflower wild coffee
8369	Psychotria greenwelliae	Kauai wild coffee
8370	Psychotria hathewayi	Waianae Range wild coffee
8371	Psychotria hathewayi var. brevipetiolata	Waianae Range wild coffee
8372	Psychotria hathewayi var. hathewayi	Waianae Range wild coffee
8373	Psychotria hawaiiensis	kopiko 'ula
8374	Psychotria hawaiiensis var. hawaiiensis	kopiko 'ula
8375	Psychotria hawaiiensis var. hillebrandii	kopiko 'ula
8376	Psychotria hawaiiensis var. scoriacea	kopiko 'ula
8377	Psychotria hexandra	woodland wild coffee
8378	Psychotria hexandra ssp. hexandra	woodland wild coffee
8379	Psychotria hexandra ssp. hexandra var. hexandra	woodland wild coffee
8380	Psychotria hexandra ssp. hexandra var. hirta	woodland wild coffee
8381	Psychotria hexandra ssp. hexandra var. kealiae	woodland wild coffee
8382	Psychotria hexandra ssp. oahuensis	Oahu wild coffee
8383	Psychotria hexandra ssp. oahuensis var. hosakana	Oahu wild coffee
8384	Psychotria hexandra ssp. oahuensis var. oahuensis	Oahu wild coffee
8385	Psychotria hexandra ssp. oahuensis var. rockii	Oahu wild coffee
8386	Psychotria hobdyi	milolii kopiwai
8388	Psychotria kaduana	kopiko kea
8392	Psychotria mariniana	forest wild coffee
8393	Psychotria mauiensis	'opiko

8400	Psychotria spp.	wild coffee
8401	Psychotria wawrae	leatherleaf wild coffee
8402	Psydrax odorata	alahe'e
8404	Pteralyxia kauaiensis	Kauai pteralyxia
8405	Pteralyxia macrocarpa	ridged pteralyxia
8406	Pteralyxia spp.	pteralyxia
8423	Quercus spp.	oak
8424	Quercus suber	cork oak
8434	Rauvolfia sandwicensis	devil's-pepper
8435	Rauvolfia spp.	devil's-pepper
8442	Reynoldsia sandwicensis	'ohe makai
8443	Reynoldsia spp.	reynoldsia
989	Rhizophora mangle	American mangrove
8463	Rhizophora spp.	mangrove
8465	Rhodomyrtus spp.	rose myrtle
8467	Rhus sandwicensis	neneleau
8468	Rhus spp.	sumac
8472	Ricinus communis	castorbean
8473	Ricinus spp.	ricinus
8505	Samanea saman	raintree
8506	Samanea spp.	raintree
8508	Sambucus nigra	European black elderberry
8509	Sambucus nigra ssp. canadensis	common elderberry
8510	Sambucus spp.	raintree
8516	Santalum ellipticum	coastal sandalwood
8517	Santalum freycinetianum	forest sandalwood
8518	Santalum freycinetianum var. freycinetianum	forest sandalwood
8519	Santalum freycinetianum var. lanaiense	Lanai sandalwood
8520	Santalum freycinetianum var. pyrularium	forest sandalwood
8521	Santalum haleakalae	Haleakala sandalwood
8522	Santalum paniculatum	mountain sandalwood
8523	Santalum paniculatum var. paniculatum	mountain sandalwood
8524	Santalum paniculatum var. pilgeri	Pilger's sandalwood
8525	Santalum salicifolium	willowleaf sandalwood
8526	Santalum spp.	sandalwood
8528	Sapindus oahuense	lonomea
8529	Sapindus saponaria	wingleaf soapberry

8530	Sapindus saponaria var. saponaria	wingleaf soapberry
8531	Sapindus spp.	soapberry
8548	Scaevola cerasifolia	Scaevola, naupaka
8549	Scaevola chamissoniana	naupaka kuahiwi
8550	Scaevola gaudichaudiana	mountain naupaka
8551	Scaevola procera	forest naupaka
8552	Scaevola spp.	naupaka
8553	Scaevola taccada	beach naupaka
8555	Schaefferia spp.	schaefferia
888	Schefflera actinophylla	octopus tree
8561	Schinus molle	Peruvian peppertree
8563	Schinus terebinthifolius	Brazilian peppertree
8564	Schinus terebinthifolius var. raddianus	Brazilian peppertree
8588	Senna alata	emperor's candlesticks
8590	Senna gaudichaudii	Gaudichaud's senna
8591	Senna multijuga	false sicklepod
8592	Senna pendula	valamuerto
8593	Senna pendula var. advena	valamuerto
8595	Senna septemtrionalis	senna
6420	Senna siamea	Siamese cassia
8598	Senna spp.	senna
8599	Senna sulfurea	smooth senna
8600	Senna surattensis	glossy shower
8606	Sesbania sesban	Egyptian riverhemp
8607	Sesbania spp.	riverhemp
8609	Sida fallax	yellow llima
8610	Sida spp.	fanpetals
8631	Solanum mauritianum	earleaf nightshade
8635	Solanum spp.	nightshade
8636	Solanum torvum	turkey berry
8641	Sophora chrysophylla	mamani
8642	Sophora spp.	necklacepod
8644	Spathodea campanulata	African tuliptree
8645	Spathodea spp.	spathodea
8670	Streblus pendulinus	Hawai'i roughbush
8671	Streblus spp.	streblus
8679	Swietenia macrophylla	Honduras mahogany
8680	Swietenia mahagoni	West Indian mahogany
8682	Swietenia spp.	mahogany
8689	Syncarpia glomulifera	turpentine tree
8690	Syncarpia spp.	turpentine tree

896	Syzygium cumini	Java plum
8701	Syzygium jambos	Malabar plum
8702	Syzygium malaccense	Malaysian apple
8706	Syzygium sandwicense	'ohi'a ha
8708	Syzygium spp.	syzygium
8488	Tabebuia spp.	trumpet-tree
897	Tamarindus indica	tamarind
8741	Tecoma castanifolia	chestnutleaf trumpetbush
8743	Tecoma stans	yellow trumpetbush
8744	Tectona grandis	teak
8745	Tectona spp.	tectona
8750	Terminalia catappa	troipical almond
8756	Terminalia myriocarpa	East Indian almond
8770	Tetraplasandra flynnii	Flynn's 'ohe
8771	Tetraplasandra gymnocarpa	Koolau Range 'ohe
8772	Tetraplasandra hawaiensis	Hawai'i 'ohe
8773	Tetraplasandra kavaiensis	'ohe'ohe
8774	Tetraplasandra oahuensis	'ohe mauka
8775	Tetraplasandra spp.	tetraplasandra
8776	Tetraplasandra waialealae	Mt. Waialeale 'ohe
8777	Tetraplasandra waimeae	'ohe kiko 'ola
8779	Tetrazygia bicolor	Florida clover ash
8787	Thespesia populnea	Portia tree
8788	Thespesia spp.	thespesia
8789	Thevetia peruviana	luckynut
8804	Tibouchina spp.	glorytree
8805	Tibouchina urvilleana	princess-flower
8812	Toona ciliata	Australian redcedar
8813	Toona ciliata ssp. ciliata	Australian redcedar
8814	Toona ciliata ssp. ciliata var. australis	Australian redcedar
8815	Toona spp.	redcedar
8822	Touchardia latifolia	olona
8823	Touchardia spp.	touchardia
8824	Tournefortia argentea	velvetleaf soldierbush
8826	Tournefortia spp.	soldierbush
998	Tree broadleaf	Tree, broadleaf
299	Tree evergreen	Tree, evergreen
999	Tree unknown	Tree
8831	Trema orientalis	oriental trema
8832	Trema spp.	trema
8856	Urera glabra	hopue
8857	Urera kaalae	opuhe

8858	Urera spp.	urera
8869	Vernicia montana	mu oil tree
8870	Vernicia spp.	vernicia
8874	Vitex parviflora	smallflower chastetree
8875	Vitex spp.	chastetree
8876	Vitex trifolia	simpleleaf chastetree
8877	Vitex trifolia var. bicolor	simpleleaf chastetree
8878	Vitex trifolia var. subtrisecta	simpleleaf chastetree
8879	Vitex trifolia var. trifolia	simpleleaf chastetree
8880	Vitex trifolia var. variegata	varigated chastetree
8889	Wikstroemia bicornuta	alpine false ohelo
8890	Wikstroemia furcata	forest false ohelo
8891	Wikstroemia monticola	montane false ohelo
8892	Wikstroemia oahuensis	Oahu false ohelo
8893	Wikstroemia oahuensis var. oahuensis	Oahu false ohelo
8894	Wikstroemia oahuensis var. palustris	Oahu false ohelo
8895	Wikstroemia phillyreifolia	Hawai'i false ohelo
8896	Wikstroemia pulcherrima	Kohala false ohelo
8897	Wikstroemia sandwicensis	variableleaf false ohelo
8898	Wikstroemia skottsbergiana	Skottsberg's false ohelo
8899	Wikstroemia spp.	false ohelo
8900	Wikstroemia villosa	hairy false ohelo
8907	Xylosma crenata	sawtooth logwood
8908	Xylosma hawaiiensis	Hawai'i brushholly
8915	Xylosma spp.	xylosma
8925	Zanthoxylum dipetalum	kawa'u
8926	Zanthoxylum dipetalum var. dipetalum	kawa'u
8927	Zanthoxylum dipetalum var. tomentosum	kawa'u
8929	Zanthoxylum hawaiiense	Hawai'i pricklyash
8930	Zanthoxylum kauaense	Kauai pricklyash
8933	Zanthoxylum oahuense	Oahu pricklyash
8936	Zanthoxylum spp.	pricklyash

All Trees: ordered by number code

Species_Code	PLANTS_Accepted_Name	COMMON_NAME
299	Tree evergreen	Tree, evergreen
303	Acacia farnesiana	sweet acacia
341	Ailanthus altissima	tree of heaven
511	Eucalyptus globulus	Tasmanian bluegum
512	Eucalyptus camaldulensis	river redgum
513	Eucalyptus grandis	grand eucalyptus
514	Eucalyptus robusta	swampmahogany
541	Fraxinus americana	white ash
681	Morus alba	white mulberry
856	Casuarina glauca	gray sheoak
858	Cinnamomum camphora	camphortree
885	Mangifera indica	mango
887	Piscidia piscipula	Florida fishpoison tree
888	Schefflera actinophylla	octopus tree
896	Syzygium cumini	Java plum
897	Tamarindus indica	tamarind
908	Cocos nucifera	coconut palm
987	Conocarpus erectus	button mangrove
989	Rhizophora mangle	American mangrove
992	Melaleuca quinquenervia	punktree
993	Melia azedarach	Chinaberrytree
998	Tree broadleaf	Tree, broadleaf
999	Tree unknown	Tree
6002	Acacia aneura	mulga
6004	Acacia confusa	small Philippine acacia
6006	Acacia koa	koa
6007	Acacia koaia	koaoha
6010	Acacia mearnsii	black wattle
6011	Acacia melanoxylon	blackwood
6014	Acacia parramattensis	South Wales wattle
6016	Acacia spp.	acacia
6028	Adenanthera pavonina	red beadtree
6029	Adenanthera spp.	beadtree
6051	Ailanthus spp.	ailanthus
6057	Albizia chinensis	Chinese albizia
6059	Albizia lebbeck	woman's tongue
6062	Albizia saponaria	whiteflower albizia
6063	Albizia spp.	albizia
6069	Alectryon macrococcus	Hawai'i alectryon
6070	Alectryon macrococcus var. auwahiensis	Hawai'i alectryon

6071	Alectryon macrococcus var. macrococcus	Hawai'i alectryon
6073	Alectryon spp.	alectryon
6075	Aleurites moluccana	Indian walnut
6076	Aleurites moluccana var. katoi	Indian walnut
6077	Aleurites spp.	aleurites
6086	Alnus nepalensis	Nepal alder
6087	Alnus spp.	alder
6089	Alphitonia ponderosa	Hawai'i kauilatree
6095	Alstonia macrophylla	deviltree
6097	Alstonia spp.	alstonia
6135	Antidesma kapuae	Kapua china laurel
6139	Antidesma platyphyllum	ha'a
6140	Antidesma platyphyllum var. hillebrandii	Hillebrand's ha'a
6141	Antidesma platyphyllum var. platyphyllum	ha'a
6143	Antidesma pulvinatum	hame
6145	Antidesma spp.	chinalaurel
6154	Araucaria angustifolia	parana pine
6155	Araucaria columnaris	New Caledonia pine
6159	Archontophoenix alexandrae	Alexandra palm
6161	Ardisia elliptica	shoebutton
6166	Ardisia spp.	marlberry
6171	Artocarpus altilis	breadfruit
6215	Bambusa spp.	bamboo
6216	Bambusa vulgaris	common bamboo
6226	Bauhinia monandra	Napoleon's plume
6230	Bauhinia spp.	bauhinia
6236	Bischofia javanica	Javanese bishopwood
6237	Bischofia spp.	bishopwood
6238	Bixa orellana	lipsticktree
6239	Bixa spp.	bixa
6242	Bobea brevipes	'akupa
6243	Bobea elatior	'ahakea lau nui
6244	Bobea sandwicensis	Hawai'i dogweed
6245	Bobea spp.	'ahakea
6246	Bobea timonioides	'ahakea
6247	Bocconia frutescens	parrotweed
6248	Bocconia spp.	bocconia
6260	Broussaisia arguta	kanawao
6262	Broussonetia papyrifera	paper mulberry
6264	Brugmansia candida	angel's-trumpet

6267	Bruguiera parviflora	smallflower bruguiera
6268	Bruguiera sexangula	Oriental mangrove
6269	Bruguiera spp.	bruguiera
6286	Buddleja asiatica	dogtail
6318	Caesalpinia kavaiensis	uhiuhi
6341	Calophyllum inophyllum	Alexandrian laurel
6345	Calophyllum spp.	calophyllum
6346	Calotropis procera	roostertree
6347	Calotropis spp.	calotropis
6395	Carica papaya	papaya
6396	Carica spp.	papaya
6397	Carmona retusa	scorpionbush
6398	Carmona spp.	scorpionbush
6420	Senna siamea	Siamese cassia
6433	Casuarina cunninghamiana	river sheoak
6434	Casuarina equisetifolia	beach sheoak
6438	Casuarina spp.	sheoak
6441	Cecropia obtusifolia	trumpet tree
6444	Cecropia spp.	pumpwood
6469	Cereus hildmannianus	hedge cactus
6470	Cereus spp.	sweetpotato cactus
6473	Cestrum aurantiacum	orange jessamine
6474	Cestrum diurnum	day jessamine
6477	Cestrum nocturnum	night jessamine
6478	Cestrum spp.	jessamine
6482	Chamaesyce atrococca	koko
6483	Chamaesyce celastroides	'ekoko
6484	Chamaesyce celastroides var. amplectens	'ekoko
6485	Chamaesyce celastroides var. celastroides	'ekoko
6486	Chamaesyce celastroides var. hanapepensis	'ekoko
6487	Chamaesyce celastroides var. kaenana	'ekoko
6488	Chamaesyce celastroides var. laehiensis	'ekoko
6489	Chamaesyce celastroides var. lorifolia	'ekoko
6490	Chamaesyce celastroides var. stokesii	'ekoko
6491	Chamaesyce celastroides var. tomentella	'ekoko
6492	Chamaesyce herbstii	Herbst's sandmat

6493	Chamaesyce kuwaleana	kokomalei
6494	Chamaesyce olowaluana	alpine sandmat
6495	Chamaesyce rockii	Koolau Range sandmat
6496	Chamaesyce spp.	sandmat
6497	Charpentiera densiflora	Napali coast papala
6498	Charpentiera elliptica	ellipticleaf papala
6499	Charpentiera obovata	broadleaf papala
6500	Charpentiera ovata	Koolau Range papala
6501	Charpentiera ovata var. niuensis	Koolau Range papala
6502	Charpentiera ovata var. ovata	Koolau Range papala
6503	Charpentiera spp.	papala
6504	Charpentiera tomentosa	Waianae Range papala
6505	Charpentiera tomentosa var. maakuaensis	Waianae Range papala
6506	Charpentiera tomentosa var. tomentosa	Waianae Range papala
6507	Cheirodendron dominii	Domin's club
6508	Cheirodendron fauriei	Faurie's club
6509	Cheirodendron forbesii	olapa
6510	Cheirodendron platyphyllum	lapalapa
6511	Cheirodendron platyphyllum ssp. kauaiense	lapalapa
6512	Cheirodendron platyphyllum ssp. platyphyllum	lapalapa
6513	Cheirodendron spp.	cheirodendron
6514	Cheirodendron trigynum	olapalapa
6515	Cheirodendron trigynum ssp. helleri	olapalapa
6516	Cheirodendron trigynum ssp. trigynum	olapalapa
6517	Chenopodium oahuense	alaweo
6518	Chenopodium spp.	goosefoot
6542	Chrysophyllum oliviforme	satinleaf
6545	Cibotium heleniae	Hāpu'u, Hawaiian tree fern
6546	Cibotium chamissoi	Chamisso's manfern
6547	Cibotium glaucum	hapu'u
6548	Cibotium menziesii	hapu'u li
6549	Cibotium spp.	manfern
6552	Cinchona pubescens	quinine

6553	Cinchona spp.	cinchona
6555	Cinnamomum burmannii	Padang cassia
6563	Cinnamomum spp.	cinnamon
6564	Cinnamomum verum	cinnamon
6565	Citharexylum caudatum	juniper berry
6567	Citharexylum spinosum	spiny fiddlewood
6568	Citharexylum spp.	fiddlewood
6591	Claoxylon sandwicense	po'ola
6592	Claoxylon spp.	claoxylon
6596	Clermontia leptoclada	oha wai nui, Clermontia
6597	Clermontia arborescens	'oha wai nui
6598	Clermontia arborescens ssp. arborescens	'oha wai nui
6599	Clermontia arborescens ssp. waihiae	'oha wai nui
6600	Clermontia arborescens ssp. waikoluensis	oha wai nui, Clermontia
6601	Clermontia clermontioides	Kauai clermontia
6602	Clermontia clermontioides ssp. clermontioides	Kauai clermontia
6603	Clermontia clermontioides ssp. rockiana	Kauai clermontia
6604	Clermontia drepanomorpha	Kohala Mountain clermontia
6605	Clermontia fauriei	haha'aiakamanu
6606	Clermontia grandiflora	bog clermontia
6607	Clermontia grandiflora ssp. grandiflora	bog clermontia
6608	Clermontia grandiflora ssp. maxima	oha wai nui, Clermontia
6609	Clermontia grandiflora ssp. munroi	bog clermontia
6610	Clermontia hawaiiensis	'oha kepau
6611	Clermontia kakeana	forest clermontia
6612	Clermontia kohalae	Waipio Valley clermontia
6613	Clermontia lindseyana	hillside clermontia
6614	Clermontia micrantha	Maui clermontia
6615	Clermontia montis-loa	Mauna Loa clermontia
6616	Clermontia oblongifolia	Oahu clermontia
6617	Clermontia oblongifolia ssp. brevipes	Oahu clermontia

6618	Clermontia oblongifolia ssp. mauiensis	Oahu clermontia
6619	Clermontia oblongifolia ssp. oblongifolia	Oahu clermontia
6620	Clermontia pallida	Wailai Pali clermontia
6621	Clermontia parviflora	smallflower clermontia
6622	Clermontia peleana	pele clermontia
6625	Clermontia persicifolia	Waioiani clermontia
6626	Clermontia pyrularia	Hamakua clermontia
6628	Clermontia spp.	clermontia
6629	Clermontia tuberculata	Haleakala clermontia
6630	Clermontia waimeae	swampforest clermontia
6632	Clerodendrum chinense	stickbush
6633	Clerodendrum glabrum	Natal glorybower
6634	Clerodendrum indicum	turk's turbin
6635	Clerodendrum macrostegium	velvetleaf glorybower
6636	Clerodendrum spp.	glorybower
6651	Clusia rosea	scotch attorney
6652	Clusia spp.	attorney
6670	Coccoloba uvifera	seagrape
6681	Cocos spp.	coconut palm
6684	Coffea arabica	Arabian coffee
6687	Coffea spp.	coffee
6694	Colubrina asiatica	Asian nakedwood
6697	Colubrina oppositifolia	kauila
6699	Colubrina spp.	nakedwood
6709	Conocarpus spp.	mangrove
6716	Coprosma foliosa	forest mirrorplant
6717	Coprosma kauensis	koi
6718	Coprosma longifolia	Oahu mirrorplant
6719	Coprosma montana	alpine mirrorplant
6720	Coprosma ochracea	Maui mirrorplant
6721	Coprosma pubens	pubescent mirrorplant
6722	Coprosma rhynchocarpa	woodland mirrorplant
6724	Coprosma spp.	mirrorplant
6726	Coprosma waimeae	'olena
6731	Cordia collococca	red manjack
6733	Cordia dichotoma	fragrant manjack
6741	Cordia spp.	cordia
6742	Cordia subcordata	kou
6744	Cordyline fruticosa	tiplant
6745	Cordyline spp.	cordyline
6749	Corymbia calophylla	redgum

6750	Corymbia citriodora	lemonscented gum
6751	Corymbia ficifolia	redflower gum
6752	Corymbia gummifera	red bloodwood
6754	Corynocarpus laevigatus	karaka nut
6755	Corynocarpus spp.	corynocarpus
6771	Crotalaria longirostrata	longbeak rattlebox
6781	Cryptocarya mannii	holio
6783	Cryptocarya spp.	cryptocarya
6787	Cryptomeria spp.	Japanese cedar
6795	Cupressus lusitanica	cedar-of-Goa
6796	Cupressus sempervirens	Italian cypress
6797	Cupressus spp.	cypress
6800	Cyanea aculeatiflora	Haleakala cyanea
6801	Cyanea arborea	palmtree cyanea
6802	Cyanea fissa	Kauai cyanea
6803	Cyanea fissa ssp. fissa	Kauai cyanea
6804	Cyanea fissa ssp. gayana	Kauai cyanea
6805	Cyanea floribunda	Degener's cyanea
6806	Cyanea giffardii	Kilauea Mauna cyanea
6807	Cyanea hamatiflora	wetforest cyanea
6808	Cyanea hamatiflora ssp. carlsonii	Carlson's cyanea
6809	Cyanea hamatiflora ssp. hamatiflora	wetforest cyanea
6810	Cyanea hardyi	Oahu cyanea
6811	Cyanea horrida	prickly cyanea
6812	Cyanea kuhihewa	Limahuli Valley cyanea
6813	Cyanea kunthiana	Kunth's cyanea
6814	Cyanea leptostegia	giant kokee cyanea
6815	Cyanea macrostegia	purple cyanea
6816	Cyanea macrostegia ssp. gibsonii	Gibson's cyanea
6817	Cyanea macrostegia ssp. macrostegia	purple cyanea
6818	Cyanea marksii	Marks' cyanea
6819	Cyanea pilosa	hairy cyanea
6820	Cyanea pilosa ssp. longipedunculata	hairy cyanea
6821	Cyanea pilosa ssp. pilosa	hairy cyanea
6822	Cyanea pohaku	pohaku cyanea
6823	Cyanea procera	Molokai cyanea
6824	Cyanea pycnocarpa	manyfruit cyanea
6825	Cyanea quercifolia	oakleaf cyanea

6826	Cyanea rivularis	plateau delissea
6827	Cyanea solenocalyx	pua kala
6828	Cyanea spp.	cyanea
6829	Cyanea stictophylla	Kaiholena cyanea
6830	Cyanea superba	Mt. Kaala cyanea
6831	Cyanea superba ssp. regina	Mt. Kaala cyanea
6832	Cyanea superba ssp. superba	Mt. Kaala cyanea
6833	Cyanea tritomantha	'aku 'aku
6837	Cyathea cooperi	Cooper's cyathea
6847	Cyathea spp.	treefern
6864	Cyrtandra ramosissima	Cyrtandra
6865	Cyrtandra giffardii	forest cyrtandra
6866	Cyrtandra spp.	cyrtandra
6875	Delissea fallax	Hawai'i delissea
6876	Delissea laciniata	cutleaf delissea
6877	Delissea niihauensis	Niihau delissea
6878	Delissea niihauensis ssp. kauaiensis	leechleaf delissea
6879	Delissea niihauensis ssp. niihauensis	Niihau delissea
6880	Delissea parviflora	smallflower delissea
6881	Delissea spp.	delissea
6882	Delissea undulata	leechleaf delissea
6883	Delonix regia	royal poinciana
6884	Delonix spp.	delonix
6898	Dillenia suffruticosa	shrubby dillenia
6900	Diospyros blancoi	mabolo
6906	Diospyros hillebrandii	elama
6911	Diospyros sandwicensis	lama
6913	Diospyros spp.	diospyros
6930	Dovyalis hebecarpa	Ceylon gooseberry
6944	Dubautia demissifolia	Dubautia
6945	Dubautia fallax	Dubautia
6946	Dubautia montana	Dubautia
6947	Dubautia arborea	Mauna Kea dubautia
6948	Dubautia knudsenii	forest dubautia
6949	Dubautia knudsenii ssp. filiformis	forest dubautia
6950	Dubautia knudsenii ssp. knudsenii	forest dubautia
6951	Dubautia knudsenii ssp. nagatae	forest dubautia
6952	Dubautia microcephala	Kauai dubautia

6953	Dubautia plantaginea	plantainleaf dubautia
6954	Dubautia plantaginea ssp. humilis	plantainleaf dubautia
6955	Dubautia plantaginea ssp. magnifolia	plantainleaf dubautia
6956	Dubautia plantaginea ssp. plantaginea	plantainleaf dubautia
6957	Dubautia reticulata	netvein dubautia
6958	Dubautia spp.	dubautia
6961	Duranta erecta	golden dewdrops
6975	Elaeocarpus bifidus	kalia
6996	Enterolobium cyclocarpum	monkeysoap
6998	Eriobotrya japonica	loquat
6999	Eriobotrya spp.	loquat
7012	Erythrina sandwicensis	wili wili
7013	Erythrina spp.	erythrina
7015	Erythrina variegata	tiger's claw
7025	Eucalyptus botryoides	southern mahogany
7026	Eucalyptus bridgesiana	applebox
7028	Eucalyptus cinerea	argyle apple
7030	Eucalyptus cladocalyx	sugargum
7031	Eucalyptus cornuta	yate
7032	Eucalyptus crebra	narrowleaf red ironbark
7033	Eucalyptus deanei	roundleaf gum
7034	Eucalyptus deglupta	Indonesian gum
7036	Eucalyptus globulus ssp. globulus	Tasmanian bluegum
7037	Eucalyptus globulus ssp. Maidenii	Tasmanian bluegum
7038	Eucalyptus gomphocephala	tuart
7039	Eucalyptus goniocalyx	mountain graygum
7041	Eucalyptus hemiphloia	white box
7042	Eucalyptus hemiphloia var. albens	whitebox
7044	Eucalyptus marginata	jarrah
7045	Eucalyptus microcorys	Australian tallowwood
7046	Eucalyptus paniculata	gray ironbark
7047	Eucalyptus pilularis	blackbutt
7048	Eucalyptus raveretiana	black ironbox
7049	Eucalyptus resinifera	redmahogany
7051	Eucalyptus rudis	Western Australian floodedgum
7052	Eucalyptus salicifolia	black peppermint

7053	Eucalyptus saligna	Sydney bluegum
7054	Eucalyptus sideroxylon	red ironbark
7055	Eucalyptus spp.	gum
7056	Eucalyptus tereticornis	forest redgum
7057	Eucalyptus viminalis	manna gum
7079	Eugenia koolauensis	nioi
7091	Eugenia reinwardtiana	mountain stopper
7096	Eugenia spp.	stopper
7104	Eugenia uniflora	Surinam cherry
7110	Euphorbia haeleeleana	Kauai spurge
7114	Euphorbia pulcherrima	poinsettia
7115	Euphorbia spp.	spurge
7116	Euphorbia tirucalli	Indiantree spurge
7119	Eurya sandwicensis	anini
7120	Eurya spp.	eurya
7131	Exocarpos gaudichaudii	hulumoa
7132	Exocarpos spp.	exocarpos
7144	Falcataria moluccana	peacocksplume
7145	Falcataria spp.	peacocksplume
7160	Ficus microcarpa	Chinese banyan
7162	Ficus nota	tibig
7167	Ficus rubiginosa	Port Jackson fig
7171	Ficus spp.	fig
7175	Ficus thonningii	Chinese banyan
7182	Fitchia speciosa	burrdaisytree
7188	Flindersia brayleyana	Queensland maple
7192	Flueggea neowawraea	mehamehame
7193	Flueggea spp.	bushweed
7200	Frangula californica	California buckthorn
7201	Frangula californica ssp. californica	California buckthorn
7206	Fraxinus uhdei	shamel ash
7207	Fuchsia boliviana	Bolivian fuchsia
7208	Fuchsia paniculata	shrubby fuchsia
7209	Fuchsia spp.	fuchsia
7211	Persea americana	avocado
7224	Gardenia brighamii	forest gardenia
7225	Gardenia mannii	Oahu gardenia
7226	Gardenia remyi	Remy's gardenia
7227	Gardenia spp.	gardenia
7228	Gardenia taitensis	Tahitian gardenia
7262	Gossypium barbadense	Creole cotton
7263	Gossypium hirsutum	upland cotton

7264	Gossypium hirsutum var. hirsutum	upland cotton
7272	Grevillea banksii	kahiliflower
7273	Grevillea robusta	silkoak
7274	Grevillea spp.	grevillea
7321	Haematoxylum campechianum	bloodwoodtree
7343	Hedyotis fosbergii	Fosberg's starviolet
7344	Hedyotis hillebrandii	manono
7345	Hedyotis spp.	starviolet
7346	Hedyotis terminalis	variable starviolet
7349	Heliocarpus popayanensis	white moho
7350	Heliocarpus spp.	heliocarpus
7370	Hesperomannia arborescens	Lanai island-aster
7371	Hesperomannia arbuscula	Maui island-aster
7372	Hesperomannia lydgatei	Kauai island-aster
7373	Hesperomannia spp.	island-aster
7374	Heteromeles arbutifolia	toyon
7375	Heteromeles arbutifolia var. arbutifolia	toyon
7376	Heteromeles spp.	toyon
7383	Hibiscadelphus puakuahiwi	hau kuahiwi
7384	Hibiscadelphus bombycinus	hau kuahiwi
7385	Hibiscadelphus crucibracteatus	lava hau kuahiwi
7386	Hibiscadelphus distans	Kauai hau kuahiwi
7387	Hibiscadelphus giffardianus	Kilauea hau kuahiwi
7388	Hibiscadelphus hualalaiensis	Hualalai hau kuahiwi
7390	Hibiscadelphus spp.	hibiscadelphus
7391	Hibiscadelphus wilderianus	Maui hau kuahiwi
7392	Hibiscadelphus woodii	Wood's hau kuahiwi
7393	Hibiscus arnottianus	white rosemallow
7394	Hibiscus arnottianus ssp. arnottianus	white rosemallow
7395	Hibiscus arnottianus ssp. immaculatus	white rosemallow
7396	Hibiscus arnottianus ssp. punaluuensis	punaluu rosemallow
7397	Hibiscus brackenridgei	Brackenridge's rosemallow
7398	Hibiscus brackenridgei ssp. brackenridgei	Brackenridge's rosemallow
7399	Hibiscus brackenridgei ssp. mokuleianus	Mokulei rosemallow

7400	Hibiscus brackenridgei ssp. molokaianus	ma'o hau hele
7401	Hibiscus calyphyllus	lemonyellow rosemallow
7402	Hibiscus clayi	red Kauai rosemallow
7403	Hibiscus elatus	mahoe
7404	Hibiscus kokio	red rosemallow
7405	Hibiscus kokio ssp. kokio	red rosemallow
7406	Hibiscus kokio ssp. saintjohnianus	St. John's rosemallow
7407	Hibiscus macrophyllus	largeleaf rosemallow
7408	Hibiscus mutabilis	Dixie rosemallow
7411	Hibiscus spp.	rosemallow
7412	Hibiscus tiliaceus	sea hibiscus
7413	Hibiscus waimeae	white Kauai rosemallow
7414	Hibiscus waimeae ssp. hannerae	white Kauai rosemallow
7415	Hibiscus waimeae ssp. waimeae	white Kauai rosemallow
7440	Hylocereus spp.	nightblooming cactus
7441	Hylocereus undatus	nightblooming cactus
7448	Hypericum canariense	Canary Island St. Johnswort
7453	Ilex anomala	Hawai'i holly
7454	Ilex aquifolium	English holly
7460	Ilex paraguariensis	mate
7464	Ilex spp.	holly
7482	Jacaranda mimosifolia	black poui
7483	Jacaranda spp.	jacaranda
7491	Jatropha curcas	Barbados nut
7494	Jatropha spp.	nettlespurge
7509	Kokia cookei	Molokai treecotton
7510	Kokia drynarioides	Hawai'i treecotton
7511	Kokia kauaiensis	Kauai treecotton
7512	Kokia lanceolata	Wailupe Valley treecotton
7513	Kokia spp.	treecotton
7516	Kunzea ericoides	burgan
7517	Kunzea spp.	Kunzea
7518	Labordia fagraeoidea	summit labordia
7519	Labordia hedyosmifolia	bog labordia
7520	Labordia hirtella	mountain labordia

7521	Labordia kaalae	Waianae Range labordia
7522	Labordia lydgatei	Wahiawa Mountain labordia
7523	Labordia spp.	labordia
7524	Labordia tinifolia	paleflower labordia
7525	Labordia tinifolia var. lanaiensis	Lanai labordia
7526	Labordia tinifolia var. tinifolia	paleflower labordia
7527	Labordia tinifolia var. wahiawaensis	Wahiawa labordia
7528	Labordia triflora	Lanai labordia
7529	Labordia waiolani	Nevada peavine
7558	Leptospermum morrisonii	large-leaf yellow teatree
7559	Leptospermum petersonii	common teatree
7560	Leptospermum polygalifolim	common teatree
7561	Leptospermum scoparium	broom teatree
7562	Leptospermum spp.	teatree
7565	Leucaena leucocephala	white leadtree
7566	Leucaena spp.	leadtree
7575	Ligustrum sinense	Chinese privet
7576	Ligustrum spp.	privet
7588	Livistona chinensis	fountain palm
7595	Lophostemon confertus	vinegartree
7621	Macaranga mappa	pengua
7623	Macaranga spp.	macaranga
7626	Macaranga tanarius	parasol leaf tree
7639	Mallotus philippensis	kamala tree
7641	Mallotus spp.	mallotus
7659	Mangifera spp.	mango
7660	Manihot glaziovii	ceara rubbertree
7661	Manihot spp.	manihot
7709	Melaleuca spp.	melaleuca
7716	Melia spp.	melia
7719	Melicope anisata	mokihana
7720	Melicope balloui	Ballou's melicope
7721	Melicope barbigera	uahiapele
7722	Melicope christophersenii	Waianae Range melicope
7723	Melicope cinerea	manena
7724	Melicope clusiifolia	kukaemoa
7725	Melicope cruciata	pilo 'ula
7726	Melicope elliptica	leiohi'iaka

7727	Melicope haleakalae	Haleakala melicope
7728	Melicope haupuensis	Haupa Mountain melicope
7729	Melicope hawaiensis	mokihana kukae moa
7730	Melicope hiiakae	Monoa melicope
7731	Melicope hosakae	Honolulu melicope
7732	Melicope kaalaensis	Kaala melicope
7733	Melicope knudsenii	Olokele Valley melicope
7734	Melicope macropus	Kaholuamanu melicope
7735	Melicope makahae	Makaha Valley melicope
7736	Melicope molokaiensis	Molokai melicope
7737	Melicope mucronulata	alani
7738	Melicope oahuensis	Oahu melicope
7739	Melicope obovata	Makawao melicope
7740	Melicope orbicularis	Honokahua melicope
7741	Melicope ovalis	Hana melicope
7742	Melicope ovata	eggshape melicope
7743	Melicope pallida	pale melicope
7744	Melicope paniculata	Lihue melicope
7745	Melicope peduncularis	boxfruit alani
7746	Melicope pseudoanisata	Kohala Summit melicope
7747	Melicope puberula	hairy melicope
7748	Melicope quadrangularis	fourangle melicope
7749	Melicope radiata	kapu melicope
7751	Melicope rotundifolia	roundleaf melicope
7752	Melicope saint-johnii	St. John's melicope
7753	Melicope sandwicensis	Mt. Kaala melicope
7754	Melicope spp.	melicope
7755	Melicope volcanica	volcanic melicope
7756	Melicope waialealae	alani wai
7757	Melicope wawraeana	Monoa melicope
7758	Melicope zahlbruckneri	kipuka piaula
7767	Melochia spp.	melochia
7769	Melochia umbellata	hierba del soldado
7782	Metrosideros macropus	'ohi'a
7783	Metrosideros polymorpha	'ohi'a lehua
7784	Metrosideros polymorpha var. dieteri	'ohi'a lehua
7785	Metrosideros polymorpha var. glaberrima	'ohi'a lehua

7786	Metrosideros polymorpha var. incana	'ohi'a lehua
7787	Metrosideros polymorpha var. macrophylla	'ohi'a lehua
7788	Metrosideros polymorpha var. newellii	'ohi'a lehua
7789	Metrosideros polymorpha var. polymorpha	'ohi'a lehua
7790	Metrosideros polymorpha var. pseudorugosa	'ohi'a lehua
7791	Metrosideros polymorpha var. pumila	'ohi'a lehua
7792	Metrosideros rugosa	lehua papa
7793	Metrosideros spp.	lehua
7794	Metrosideros tremuloides	lehua 'ahihi
7795	Metrosideros waialealae	Kauai bottlebrush
7796	Metrosideros waialealae var. fauriei	Kauai bottlebrush
7797	Metrosideros waialealae var. waialealae	Kauai bottlebrush
7805	Miconia calvescens	velvet tree
7841	Montanoa hibiscifolia	treedaisy
7842	Montanoa spp.	montanoa
7845	Morella cerifera	wax myrtle
7846	Morella faya	firetree
7848	Morella spp.	bayberry
7849	Morinda citrifolia	Indian mulberry
7852	Morinda spp.	morinda
7853	Morinda trimera	noni kuahiwi
7865	Munroidendron racemosum	false 'ohe
7867	Muntingia calabura	strawberrytree
7868	Muntingia spp.	muntingia
7872	Musa paradisiaca	French plantain
7879	Musa troglodytarum	fe'i banana
7883	Myoporum sandwicense	naio
7884	Myoporum spp.	myoporum
7892	Myrcia spp.	rodwood
7900	Myrica spp.	sweetgale
7910	Myrsine alyxifolia	forest colicwood
7913	Myrsine degeneri	summit colicwood
7914	Myrsine emarginata	mountain colicwood
7915	Myrsine fernseei	streambank colicwood
7916	Myrsine fosbergii	Koolau Range colicwood

7918	Myrsine helleri	Wahiawa Bog colicwood
7919	Myrsine kauaiensis	Kauai colicwood
7920	Myrsine knudsenii	Kokee colicwood
7921	Myrsine lanaiensis	Lanai colicwood
7922	Myrsine lessertiana	kolea lau nui
7923	Myrsine mezii	Hanapepe River colicwood
7924	Myrsine petiolata	swamp colicwood
7925	Myrsine pukooensis	Molokai colicwood
7926	Myrsine sandwicensis	kokea lau li'i
7927	Myrsine spp.	colicwood
7928	Myrsine wawraea	Mt. Kahili colicwood
7954	Neraudia melastomifolia	ma'aloa
7958	Nesoluma polynesicum	keahi
7960	Nestegis sandwicensis	Hawai'i olive
7961	Nestegis spp.	nestegis
7964	Nicotiana glauca	tree tobacco
7965	Nicotiana spp.	tobacco
7966	Nothocestrum breviflorum	smallflower aiea
7967	Nothocestrum latifolium	broadleaf aiea
7968	Nothocestrum longifolium	longleaf aiea
7969	Nothocestrum peltatum	Oahu aiea
7970	Nothocestrum spp.	aiea
7971	Nototrichium humile	kaala rockwort
7972	Nototrichium sandwicense	Hawai'i rockwort
7977	Ochna spp.	ochna
7978	Ochna thomasiana	Thomas' bird's-eye bush
7982	Ochrosia compta	holei
7983	Ochrosia haleakalae	island yellowwood
7984	Ochrosia kauaiensis	Kauai yellowwood
7985	Ochrosia kilaueaensis	Hawai'i yellowwood
7986	Ochrosia spp.	yellowwood
8004	Olea europaea	olive
8005	Olea europaea ssp. cuspidata	African olive
8006	Olea europaea ssp. europaea	European olive
8007	Olea spp.	olive
8013	Opuntia cochenillifera	cochineal nopal cactus
8014	Opuntia ficus-indica	tuna cactus
8015	Opuntia monacantha	common pricklypear
8018	Opuntia spp.	pricklypear

8084	Pandanus spp.	screwpine
8085	Pandanus tectorius	Tahitian screwpine
8111	Parkinsonia aculeata	Jerusalem thorn
8112	Parkinsonia spp.	paloverde
8131	Perrottetia sandwicensis	olomea
8137	Persea spp.	bay
8152	Phoenix dactylifera	date palm
8153	Phoenix spp.	date palm
8155	Photinia davidiana	Chinese photinia
8159	Phyllanthus distichus	pamakani mahu
8175	Pimenta dioica	allspice
8183	Pinus caribaea	Caribbean pine
8187	Pinus patula	Mexican weeping pine
8188	Pinus pinaster	maritime pine
8189	Pinus spp.	pine
8205	Pipturus albidus	Waimea pipturus
8207	Pipturus spp.	pipturus
8210	Piscidia spp.	piscidia
8212	Pisonia brunoniana	Australasian catchbirdtree
8213	Pisonia grandis	grand devil's-claws
8214	Pisonia sandwicensis	aulu
8215	Pisonia spp.	catchbirdtree
8217	Pisonia umbellifera	umbrella catchbirdtree
8218	Pisonia wagneriana	Kauai catchbirdtree
8220	Pithecellobium dulce	monkeypod
8224	Pittosporum monae	Mona cheesewood, Pittosporum
8226	Pittosporum argentifolium	Hawai'i poisonberry tree
8227	Pittosporum confertiflorum	ho'awa
8228	Pittosporum flocculosum	Waianae Range cheesewood
8229	Pittosporum gayanum	Waialeale cheesewood
8230	Pittosporum glabrum	Koolau Range cheesewood
8231	Pittosporum halophilum	ho'awa
8232	Pittosporum hawaiiense	Hawai'i cheesewood
8233	Pittosporum hosmeri	Kona cheesewood
8234	Pittosporum kauaiense	Kauai cheesewood
8235	Pittosporum napaliense	royal cheesewood
8236	Pittosporum pentandrum	Taiwanese cheesewood

8238	Pittosporum spp.	cheesewood
8239	Pittosporum terminalioides	cream cheesewood
8240	Pittosporum undulatum	Australian cheesewood
8241	Pittosporum viridiflorum	cape cheesewood
8250	Platydesma remyi	Hawai'i pilo kea
8251	Platydesma spathulata	Maui pilo kea
8252	Platydesma spp.	platydesma
8257	Pleomele aurea	golden hala pepe
8258	Pleomele auwahiensis	Maui hala pepe
8259	Pleomele fernaldii	Lanai hala pepe
8260	Pleomele forbesii	Waianae Range hala pepe
8261	Pleomele halapepe	royal hala pepe
8262	Pleomele hawaiiensis	Hawai'i hala pepe
8263	Pleomele spp.	hala pepe
8304	Pouteria sandwicensis	'ala'a
8306	Pouteria spp.	pouteria
8315	Pritchardia affinis	Hawai'i pritchardia
8316	Pritchardia arecina	Maui pritchardia
8317	Pritchardia beccariana	Kilauea pritchardia
8318	Pritchardia forbesiana	Mt. Eke pritchardia
8319	Pritchardia hardyi	Makaleha pritchardia
8320	Pritchardia hillebrandii	lo'ulu lelo
8321	Pritchardia kaalae	Waianae Range pritchardia
8322	Pritchardia lanaiensis	Lanai pritchardia
8323	Pritchardia lanigera	lo'ulu
8324	Pritchardia limahuliensis	Limahuli Valley pritchardia
8325	Pritchardia lowreyana	Molokai pritchardia
8326	Pritchardia martii	Koolau Range pritchardia
8327	Pritchardia minor	Alakai Swamp pritchardia
8328	Pritchardia munroi	Kamalo pritchardia
8330	Pritchardia perlmanii	Wai'oli Valley pritchardia
8331	Pritchardia remota	Nihoa pritchardia
8332	Pritchardia remota ssp. aylmer-robinsonii	Nihoa pritchardia
8333	Pritchardia remota ssp. glabrata	Nihoa pritchardia

8334	Pritchardia remota ssp. napaliensis	Nihoa pritchardia
8335	Pritchardia remota ssp. remota	Nihoa pritchardia
8336	Pritchardia schattaueri	lands of papa pritchardia
8337	Pritchardia spp.	pritchardia
8338	Pritchardia viscosa	stickybud pritchardia
8339	Pritchardia waialealeana	poleline pritchardia
8343	Prosopis juliflora	mesquite
8344	Prosopis pallida	kiawe
8345	Prosopis spp.	mesquite
8355	Psidium cattleianum	strawberry guava
8356	Psidium guajava	guava
8365	Psychotria fauriei	Koolau Range wild coffee
8366	Psychotria grandiflora	largeflower wild coffee
8369	Psychotria greenwelliae	Kauai wild coffee
8370	Psychotria hathewayi	Waianae Range wild coffee
8371	Psychotria hathewayi var. brevipetiolata	Waianae Range wild coffee
8372	Psychotria hathewayi var. hathewayi	Waianae Range wild coffee
8373	Psychotria hawaiiensis	kopiko 'ula
8374	Psychotria hawaiiensis var. hawaiiensis	kopiko 'ula
8375	Psychotria hawaiiensis var. hillebrandii	kopiko 'ula
8376	Psychotria hawaiiensis var. scoriacea	kopiko 'ula
8377	Psychotria hexandra	woodland wild coffee
8378	Psychotria hexandra ssp. hexandra	woodland wild coffee
8379	Psychotria hexandra ssp. hexandra var. hexandra	woodland wild coffee
8380	Psychotria hexandra ssp. hexandra var. hirta	woodland wild coffee
8381	Psychotria hexandra ssp. hexandra var. kealiae	woodland wild coffee
8382	Psychotria hexandra ssp. oahuensis	Oahu wild coffee
8383	Psychotria hexandra ssp. oahuensis var. hosakana	Oahu wild coffee

8384	Psychotria hexandra ssp. oahuensis var. oahuensis	Oahu wild coffee
8385	Psychotria hexandra ssp. oahuensis var. rockii	Oahu wild coffee
8386	Psychotria hobdyi	milolii kopiwai
8388	Psychotria kaduana	kopiko kea
8392	Psychotria mariniana	forest wild coffee
8393	Psychotria mauiensis	'opiko
8400	Psychotria spp.	wild coffee
8401	Psychotria wawrae	leatherleaf wild coffee
8402	Psydrax odorata	alahe'e
8404	Pteralyxia kauaiensis	Kauai pteralyxia
8405	Pteralyxia macrocarpa	ridged pteralyxia
8406	Pteralyxia spp.	pteralyxia
8423	Quercus spp.	oak
8424	Quercus suber	cork oak
8434	Rauvolfia sandwicensis	devil's-pepper
8435	Rauvolfia spp.	devil's-pepper
8442	Reynoldsia sandwicensis	'ohe makai
8443	Reynoldsia spp.	reynoldsia
8463	Rhizophora spp.	mangrove
8465	Rhodomyrtus spp.	rose myrtle
8467	Rhus sandwicensis	neneleau
8468	Rhus spp.	sumac
8472	Ricinus communis	castorbean
8473	Ricinus spp.	ricinus
8488	Tabebuia spp.	trumpet-tree
8505	Samanea saman	raintree
8506	Samanea spp.	raintree
8508	Sambucus nigra	European black elderberry
8509	Sambucus nigra ssp. canadensis	common elderberry
8510	Sambucus spp.	raintree
8516	Santalum ellipticum	coastal sandalwood
8517	Santalum freycinetianum	forest sandalwood
8518	Santalum freycinetianum var. freycinetianum	forest sandalwood
8519	Santalum freycinetianum var. lanaiense	Lanai sandalwood
8520	Santalum freycinetianum var. pyrularium	forest sandalwood
8521	Santalum haleakalae	Haleakala sandalwood
8522	Santalum paniculatum	mountain sandalwood

8523	Santalum paniculatum var. paniculatum	mountain sandalwood
8524	Santalum paniculatum var. pilgeri	Pilger's sandalwood
8525	Santalum salicifolium	willowleaf sandalwood
8526	Santalum spp.	sandalwood
8528	Sapindus oahuense	lonomea
8529	Sapindus saponaria	wingleaf soapberry
8530	Sapindus saponaria var. saponaria	wingleaf soapberry
8531	Sapindus spp.	soapberry
8548	Scaevola cerasifolia	Scaevola, naupaka
8549	Scaevola chamissoniana	naupaka kuahiwi
8550	Scaevola gaudichaudiana	mountain naupaka
8551	Scaevola procera	forest naupaka
8552	Scaevola spp.	naupaka
8553	Scaevola taccada	beach naupaka
8555	Schaefferia spp.	schaefferia
8561	Schinus molle	Peruvian peppertree
8563	Schinus terebinthifolius	Brazilian peppertree
8564	Schinus terebinthifolius var. raddianus	Brazilian peppertree
8588	Senna alata	emperor's candlesticks
8590	Senna gaudichaudii	Gaudichaud's senna
8591	Senna multijuga	false sicklepod
8592	Senna pendula	valamuerto
8593	Senna pendula var. advena	valamuerto
8595	Senna septemtrionalis	senna
8598	Senna spp.	senna
8599	Senna sulfurea	smooth senna
8600	Senna surattensis	glossy shower
8606	Sesbania sesban	Egyptian riverhemp
8607	Sesbania spp.	riverhemp
8609	Sida fallax	yellow Ilima
8610	Sida spp.	fanpetals
8631	Solanum mauritianum	earleaf nightshade
8635	Solanum spp.	nightshade
8636	Solanum torvum	turkey berry
8641	Sophora chrysophylla	mamani
8642	Sophora spp.	necklacepod
8644	Spathodea campanulata	African tuliptree
8645	Spathodea spp.	spathodea
8670	Streblus pendulinus	Hawai'i roughbush
8671	Streblus spp.	streblus

8679	Swietenia macrophylla	Honduras mahogany
8680	Swietenia mahagoni	West Indian mahogany
8682	Swietenia spp.	mahogany
8689	Syncarpia glomulifera	turpentine tree
8690	Syncarpia spp.	turpentine tree
8701	Syzygium jambos	Malabar plum
8702	Syzygium malaccense	Malaysian apple
8706	Syzygium sandwicense	'ohi'a ha
8708	Syzygium spp.	syzygium
8741	Tecoma castanifolia	chestnutleaf trumpetbush
8743	Tecoma stans	yellow trumpetbush
8744	Tectona grandis	teak
8745	Tectona spp.	tectona
8750	Terminalia catappa	troipical almond
8756	Terminalia myriocarpa	East Indian almond
8770	Tetraplasandra flynnii	Flynn's 'ohe
8771	Tetraplasandra gymnocarpa	Koolau Range 'ohe
8772	Tetraplasandra hawaiensis	Hawai'i 'ohe
8773	Tetraplasandra kavaiensis	'ohe'ohe
8774	Tetraplasandra oahuensis	'ohe mauka
8775	Tetraplasandra spp.	tetraplasandra
8776	Tetraplasandra waialealae	Mt. Waialeale 'ohe
8777	Tetraplasandra waimeae	'ohe kiko 'ola
8779	Tetrazygia bicolor	Florida clover ash
8787	Thespesia populnea	Portia tree
8788	Thespesia spp.	thespesia
8789	Thevetia peruviana	luckynut
8804	Tibouchina spp.	glorytree
8805	Tibouchina urvilleana	princess-flower
8812	Toona ciliata	Australian redcedar
8813	Toona ciliata ssp. ciliata	Australian redcedar
8814	Toona ciliata ssp. ciliata var. australis	Australian redcedar
8815	Toona spp.	redcedar
8822	Touchardia latifolia	olona
8823	Touchardia spp.	touchardia
8824	Tournefortia argentea	velvetleaf soldierbush
8826	Tournefortia spp.	soldierbush
8831	Trema orientalis	oriental trema
8832	Trema spp.	trema
8856	Urera glabra	hopue
8857	Urera kaalae	opuhe

8858	Urera spp.	urera
8869	Vernicia montana	mu oil tree
8870	Vernicia spp.	vernicia
8874	Vitex parviflora	smallflower chastetree
8875	Vitex spp.	chastetree
8876	Vitex trifolia	simpleleaf chastetree
8877	Vitex trifolia var. bicolor	simpleleaf chastetree
8878	Vitex trifolia var. subtrisecta	simpleleaf chastetree
8879	Vitex trifolia var. trifolia	simpleleaf chastetree
8880	Vitex trifolia var. variegata	varigated chastetree
8889	Wikstroemia bicornuta	alpine false ohelo
8890	Wikstroemia furcata	forest false ohelo
8891	Wikstroemia monticola	montane false ohelo
8892	Wikstroemia oahuensis	Oahu false ohelo
8893	Wikstroemia oahuensis var. oahuensis	Oahu false ohelo
8894	Wikstroemia oahuensis var. palustris	Oahu false ohelo
8895	Wikstroemia phillyreifolia	Hawai'i false ohelo
8896	Wikstroemia pulcherrima	Kohala false ohelo
8897	Wikstroemia sandwicensis	variableleaf false ohelo
8898	Wikstroemia skottsbergiana	Skottsberg's false ohelo
8899	Wikstroemia spp.	false ohelo
8900	Wikstroemia villosa	hairy false ohelo
8907	Xylosma crenata	sawtooth logwood
8908	Xylosma hawaiiensis	Hawai'i brushholly
8915	Xylosma spp.	xylosma
8925	Zanthoxylum dipetalum	kawa'u
8926	Zanthoxylum dipetalum var. dipetalum	kawa'u
8927	Zanthoxylum dipetalum var. tomentosum	kawa'u
8929	Zanthoxylum hawaiiense	Hawai'i pricklyash
8930	Zanthoxylum kauaense	Kauai pricklyash
8933	Zanthoxylum oahuense	Oahu pricklyash
8936	Zanthoxylum spp.	pricklyash

APPENDIX 2 – HANDHELD GPS COORDINATES

A. Overview

An objective of the inventory is to obtain accurate GPS coordinates for each field grid location. Coordinates are used to correlate plot information with remotely sensed imagery and data and in relocating the plot at future inventories. For the collection of GPS coordinates Alaska PNW-FIA uses Garmin GPSmap 76Cx GPS receivers.

B. When and where to collect readings

For each plot visited, collect a GPS reading that has averaged for at least 180 readings with an EPE (estimated position error) of 70 feet or less. Try to collect an adequate set of readings as soon as the center of subplot 1 is located. If unsuccessful, try again shortly before going to the next subplot. Success is GPS-generated coordinates based on a reading that has averaged for at least 180 readings with < 70 feet EPE. If there is no success at the plot center location, try to obtain coordinates in an opening or nearby area that gets better satellite coverage. If you can now successfully meet minimum requirements to collect, then be sure to enter the distance and azimuth to plot center in the appropriate fields (see GPS Info in the PLOT LEVEL DATA chapter). If you are still unsuccessful at getting good coordinates near the plot center, then collect them at one of the other three subplot centers and note accordingly.

NOTE: Allow at least 45 min to an hour between readings to allow for different or new satellites to come into clear view of the receiver. If more than one coordinate is collected, record the coordinate that is closest to subplot 1 center and has averaged for at least 180 readings. Write any other collected GPS coordinates or any notes regarding GPS use on the front of the location record. Record the azimuth and distance from the GPS reading location to the center of subplot 1.

** Important Note** the data recorder requires that the number of averaged readings be entered. The Garmin unit utilizes a number of readings counter and this number should be entered into the data recorder.

C. Recording GPS information

When using the GPS, record the Unit Number of the machine, UTM zone number, the Easting and Northing (X and Y) coordinates, the amount of time that readings that were averaged, the error statistic (the error displayed while the machine was averaging readings), the elevation of the reading, and the other items listed under Plot Data in the Husky Data recorder as necessary.

D. GPS keypad layout and commands

PWR: (red circle) key, hold down to turn the unit on and off. Press to adjust screen backlighting.

ENTER: (mark) press and release to enter highlighted option. Press and hold from any main menu/navigation screen to mark a waypoint.

MENU: press and release to view the Options Menu for a page. Press twice to view main menu.

QUIT: cancels the operation of the last button pressed and/or moves to previous screen

FIND: (MOB) Press to go to the find menu. Highlight waypoints and a list of saved waypoints will appear.

PAGE: press to move forward through main menu pages

IN: zooms in the display of the map screen

OUT: zooms out the display of the map screen

LEFT/RIGHT (Rocker Key) move the cursor left or right while entering data or selecting menu options

UP/DOWN (Rocker Key) move the cursor up and down while entering data or selecting menu options.

Initiate screen backlight: quickly press the PWR key.

Note: Adjust screen backlight: after turning the screen backlight on, press the power key again to brighten, press again to turn off.

E. GPS setup options

Listed below are the parameters to be set up before collecting satellite readings. Once these parameters are set up for the first time they will not need to be reset. Periodically (at least weekly) the unit should be checked to see that the settings have not been inadvertently changed.

GPS UNIT SETUP
The Garmin has several MAIN MENU screens that can be displayed or turned off. Some screens must be displayed in order to get coordinate information. Several screens display similar or the same information and it is recommended that these screens not be displayed.

When the unit is powered on, the “Main” Main Menu screen appears. Scroll to the right and highlight Setup and press ENTER key. Select the following fields one at a time and check that the correct information is set to display in each. To open each, scroll to it’s icon and press Enter. Press DOWN key to select setup option, then press the ENTER key to change units. Scroll through drop down list and press enter to update/change field. When done, Press Quit to exit and choose new field from the Setup menu.

System: set “GPS” to battery saver, set “WAAS/EGNOS” to enabled, set “battery type” to alkaline (if using this type).

Time: set “Time Zone” to US Hawaii- there is not daylight savings time .

After system and time are set, scroll to the Units icon and press Enter.

Units: To scroll through the following pages use the up/down arrows.
Position Format: UTM/UPS
MAP DATUM: WGS 84
Distance/Speed: Statute
Elevation: Feet (ft/min)

Heading: “Display” set to Degrees and “North Reference” to Magnetic

IMPORTANT: Make sure that the MAP DATUM being used is the correct DATUM specified for your area. This is set on the UNITS page. Using a different datum will alter the coordinates significantly.

MAIN MENU PAGES
The Garmin has 6 main menu screens. These can be scrolled through by pressing “Page” to scroll forward or “Quit” to scroll back through them. The menu screens are: Main Menu, Find, Satellite, Trip Computer, Compass, and Map.

*Battery status and signal strength can be checked in the status bar at the top of all Main Menu/Navigation screens.

CUSTOMIZING NAVIGATION SCREENS
It is important that navigation screens are setup consistently among all units. Office defaults will be set for each unit. While most screens can be customized, it is recommended that the office defaults remain consistent. For most screens, small numbers will be selected to show more data fields.

While on a NAV screen, press MENU to open the options menu, to change data fields highlight “change data fields” and press ENTER. Now scroll to each individual field and press ENTER to open the drop down menu. Scroll through to highlight desired field and press ENTER to set. When all fields are changed, press QUIT to save all changes.

Satellite Page: This page shows how many satellites are being received by the unit and which ones are coming into view.

Trip Computer: It is recommended that the office defaults be left for this screen. At minimum Accuracy, Time, Bearing, Heading, Elevation, and Dist. To Destination should be kept on all units.

Compass: It is recommended this screen be left as set, Accuracy, Dist to Destination, Bearing, and Heading are most useful.

Map: The map screen will be set to show map only.

F. Operating the GPS on plot

Carry extra batteries at all times. The two AA-alkaline batteries begin to lose power after approximately eight hours of use. See Section J Batteries, for more details.

1. Turn on the GPS unit

2. Check to see if the unit is receiving satellite readings by pressing the PAGE key until the satellite status screen is visible. The satellite status screen shows 2 circles in the middle of the screen, and the satellite signal strength chart at the bottom. When the unit begins receiving satellites, the Acquiring Satellites message at the top will be replaced by the EPE and current UTM.

3. All recorded coordinates (UTM), elevation, number of readings, etc are entered under Plot Level Data (GPS Info) in the data recorder. If the coordinates are recorded at plot center, then azimuth and distance to plot center will be recorded as zero. See section H (Waypoints) below for a discussion of marking and averaging your location (LZ, RP, PC).

G. Collecting coordinates away from plot center

If you can not get an adequate set of readings at plot center, you may take readings at another location, and then record the azimuth and distance to plot center so that someone in the office can calculate the coordinates at plot center. Take the GPS unit to a location where you will be able to collect 180 averaged readings at < 70ft accuracy, and where you will be able to accurately measure the horizontal distance, azimuth and slope to plot center.

Record the coordinates, elevation, number of readings, azimuth, and distance to plot center under Plot Data in the data recorder.

H. Waypoints

CREATING A WAYPOINT (when coordinates are given)
A waypoint is a fairly precise location that a GPS user may assign a number and/or label to identify. For Pacific Islands PNW-FIA the location format is UTM/UPS (Universal Transerve Mercator/ Universal Polar Stereographic). This format requires this information: Zone- a 2 digit number (01-60) with a letter (C-X) attached. For our purposes, all zones in the western US will be any combination of the numbers 10,11 and letters U,T or S. Easting – a seven digit number (usually the first digit will be a zero) that represents distance form the eastern boundary of the particular zone. Northing also a seven digit number that represents distance north of the equator(northing numbers are usually instrumental in determining what zone the coordinates are in).

To create a new waypoint with given UTM coordinates from existing plot data, turn on the GPS and then hold down the ENTER/MARK button. This will bring up the MARK screen with OK highlighted. Scroll up until the waypoint number field is highlighted. Press ENTER to rename the waypoint [(ex. “12345NAV”) see below]. In naming the waypoint, add the letters NAV when using given coordinates from the folder data to distinguish from real-on-the- ground collected GPS points. Hit OK on the keypad screen when done. Highlight Location and press ENTER. Edit both lines of the location field by using the pop up keypad to edit the UTM field. When the coordinates are displayed correctly, highlight OK and press ENTER. Edit the Elevation field in the same manner. If you need to edit the icon, or note for a waypoint, use the UP/DOWN arrows to highlight the field you wish to change and press ENTER. Edit in same manner as just described.

When you have entered all the necessary data, highlight the OK button (bottom right of screen), and press ENTER. (To navigate to a newly created waypoint, see section I below.)

MARKING/AVERAGING YOUR CURRENT LOCATION
Storing the location of a vehicle, LZ or RP, or starting point is a good example on how you can use this feature in the field. Stored waypoints can be useful in approaching locations in a different way, taking a different route back to the LZ, or if you should get lost (see navigating to a waypoint).

To start, make sure the unit is on and you are receiving good signals. Check the Satellite screen (see Section F. Operating the GPS) and be sure that you are getting strong signals. Wait until the EPE (estimated position error) is 70 feet or less.

Hold down the ENTER/MARK button until the MARK screen appears. Before you move the GPS, you need to average the point’s location. Scroll to the left and highlight AVG. Push ENTER to begin averaging. Watch the EPE and wait until the Measurement Count reaches 180. At this point, push and hold ENTER to save. Be sure to note the EPE before you save! The coordinates are now “locked in” and you can move the GPS without fear of changing the coordinates. Next, edit the waypoint name (see below). Finally, scroll to the bottom of the screen and choose OK to save the new waypoint. NOTE: when entering coordinates into the PDR for the PC, RP, LZ, etc., wait until after you have “averaged” the waypoint (don’t read off and enter the coordinates prior to averaging).

The GPS’s current location (under the assigned name), is now stored in its memory and can be used to navigate with.

NAMING COLLECTED/AVERAGED WAYPOINTS
The Garmin waypoint name allows us up to 14 numbers/letters.
The first five digits of the name should be the plot number (on the folder). (ex. if the plot number is 30 then plot number is 00030). The next 2-3 digits would be LZ, TR, RP, PC, SP2, SP3, SP4, or OTH.

LZ/TR = landing zone, or truck parking spot
RP = Reference Point
PC = Plot Center
SP2 = Subplot 2
SP3 = Subplot 3
SP4 = Subplot 4
OTH = Other, describe in GPS notes/location record

I. Navigating with the GPS

To begin navigation, you must first have a waypoint stored in the GPS unit (see Section H. Waypoints). A compass will be needed. (NOTE: keep the compass away from the body of the GPS to keep it from affecting the magnetic accuracy). Once you know which waypoint number you are going to travel towards, turn the GPS on and then, after the unit has locked onto satellites, push the FIND button. Highlight “Waypoints” in the menu, and press ENTER. A list of user-stored waypoints appears. Scroll down through the list until you find the name or number of the desired waypoint. (For example: a NAV waypoint as created in Section H) Highlight the desired waypoint and press ENTER. If you are not getting satellite signals then you will get the bearing and distance to the waypoint you selected from the last position the GPS unit obtained satellite signals. You may want to move in the general direction of the waypoint and hope that satellites will come into better view, or you may want to let the GPS sit for a few minutes to lock onto a signal.

Once you are sure you are receiving satellites you can highlight the GO TO tab on the bottom right of the screen to begin navigation. The map screen should appear and you can select which of the several navigation screens you wish to use by scrolling with the Page or Quit buttons. Follow the bearing using a compass, as you walk towards the waypoint the distance should steadily decrease. Eventually, as you get closer to the waypoint, the distance will get very small (about 10-30ft), and the bearing will begin to jump around dramatically. This means that you are very close to your destination (so look for the stake and witness trees if the waypoint is subplot 1).

Other data you might see on the navigation screens:

Bearing This is the direction to your destination from your present position, in degrees, from North.

Distance This is distance (measured in the Nav Units selected in Setup) to your destination.

Heading This is the direction you are moving (measured in degrees). When the heading and bearing are the same, you are traveling in a direct line to your destination.

Speed This is the rate that you are traveling. The unit of measure is selected in Setup - Nav Units.

J. Batteries

Garmin GPSmap76Cx units use two AA alkaline, NiMH, or lithium batteries; alkaline usually last for eight hours of use. Replace the batteries when the Power Indicator (found on the top of the navigation screens) is low. The GPS may have trouble locating satellites if the battery is low.

GPS Notes:

APPENDIX 3 – SURVEY GRADE GPS COORDINATES

HOW TO COLLECT SURVEY GRADE GPS COORDINATES

A. Turning on the GPS receiver (Javad Maxor receiver)

After arriving at the subplot center, power the unit on by pressing down the PWR button (Figure 59). If power doesn't come on after pressing the PWR button, the unit is in zero power mode and can be turned on by pressing the Reset button.

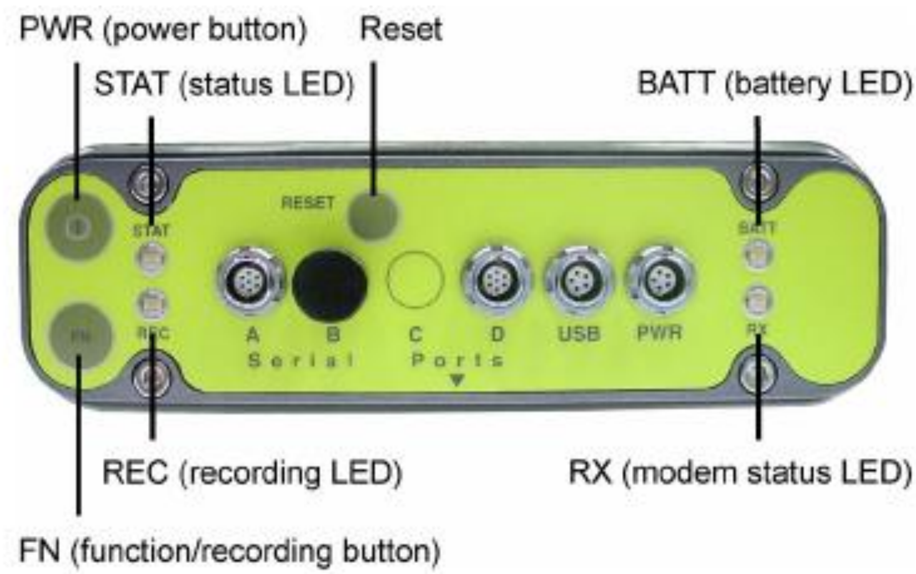


Figure 59: Javad Maxor MinPad

B. Setting up GPS receiver at subplot center

After turning the GPS unit on, screw together survey rods to assemble a 6-foot-length pole, and attach bipod legs. Place the pole next to the pin at subplot center and push the point of the pole into the soil. Stabilize the pole using the bipod legs, and adjust the length of the legs until the bubble level on the pole indicates that the rod is vertical (see Figure 60). Attach the GPS receiver to the top of the pole (it screws on to 5/8"-11 threaded end). Recheck bubble level to ensure that the pole is vertical – use the fine adjustment of the bipod legs, if necessary, to reestablish the verticality of the pole. Measure and record the height of the GPS receiver (from surface of the ground – NOT top of pin) as shown in Figure 60. Note that the measurement is taken at the base of the GPS receiver (bottommost portion where it screws on to pole).

Figure 60. GPS set-up and measurement of antenna height (black line).

C. Collecting GPS data (Javad Maxor GPS receivers)

Once the receiver and pole are set-up over the subplot center, wait for the STAT button to begin blinking green and orange indicating that the unit is receiving satellites. The STAT button will blink green once for each (American) GPS satellite and orange once for each (Russian) GLONASS satellite it is receiving a signal from. **If there is a short red blink between the satellite blinks, wait for it to go away.** This signifies that the receiver has not solved a fixed solution for the position, even though it has started to receive signals from satellites.

Once the STAT button is receiving satellites and has solved a position (no short red blink between satellite blinks), press the FN button for 1-5 seconds to begin recording data (see Figure 59). The

REC button will blink green for each epoch recorded. An epoch is one recording of satellite data at a given time. The GPS receiver will be set to record at 1 epoch/second. Since the unit is set to 1 epoch/second, the REC button should blink green once a second when the FN button is pressed to begin recording. **Enter the time that you started recording at this subplot into the field data recorder (military time, hour/minutes). Be careful not to bump or move the receiver while it is recording data. Record GPS data for at least 15 minutes at each subplot center.**

When done recording, press the FN button for 1-5 seconds to stop recording data (REC button will stop blinking each second). **Enter the time that you stopped recording into the field data recorder.** Then press the PWR button to turn the unit off.

NOTE: If it is deemed unsafe or prohibitively difficult (due to tree or branch obstructions) to set up the GPS pole and receiver at subplot center, they may be set up at a nearby location with an offset measured (record the horizontal distance and magnetic azimuth from GPS receiver to subplot center).

APPENDIX 4 – LASER 200 INSTRUCTIONS

A. Overview

Accurate heights are necessary in our inventory in order to determine volume and for other uses. The Laser can be used to get fast and accurate tree heights. It can also be used to measure distances and % slope. This instrument is more fragile than the GPS units. Some precautions must be taken with the Lasers to keep them working properly. These are:

1. Never look at the sun through the scope. Looking directly at the sun can permanently damage your eyes.
2. Never point the Laser directly at the sun. Exposing the lens system to direct sunlight, even for a brief period, may permanently damage the laser transmitter.
3. Do not expose the Laser to extreme temperatures. It is rated for a temperature range of -22 to +140 deg. F. Don't leave the instrument in the vehicle during the heat of the day.
4. Do not use batteries with "voltage check" features built on the batteries. The battery case of the Laser is too narrow for these batteries, and they could get stuck in the instrument.
5. Do not drop the Laser. Immediately return it to its case when you get back to the vehicle. There is usually more danger of damaging the instrument in the vehicle than out in the woods.

B. Basic operation

All directions for using the Laser buttons are given assuming you are holding the instrument with the LCD display screen facing you and the 2 round lenses are facing the object you want to measure. The buttons will be referred to as:

L1 the left button closest to you
L2 the left button in the middle
L3 the left button furthest away from you
R1 the right button closest to you
R2 the right button in the middle
R3 the right button furthest away from you

Turn the Laser on by pushing L1 or R1
Turn it off by pushing L2 and L3 at the same time. The Laser may turn itself off after a period of inactivity. Once the instrument is on, push the R1 button to make the red dot appear in the sighting scope. If there is no red sighting dot, repeatedly push the L2 button until the red dot appears and is the correct brightness.
To light up the display screen, press L3. Press L3 again to turn off the light.

C. Settings

Make sure the settings are correct before using the Laser. To set the correct measurement units, go into the main menu and:

1. Press R2 or R3 to scroll through the menu until SYS is displayed in the upper right hand corner of the screen.
2. Press R1. ON or OFF will show in the center of the screen. FILTER will flash at the bottom.
3. Press R2 until OFFSET is flashing. The number displayed should be 0000.00.
4. Press R2 until PIVOT is flashing. The number displayed should be 0000.59. When this number is set at 0.00, the Laser is set to calculate heights using a tripod attached to the center of the

instrument. The pivot point is the center of the Laser. We use the pivot value at 0.59 because this sets the pivot point at the rear of the instrument, and this allows you to shoot a height while using your head as the pivot point. To change this number, press L1 until the number you want to change is flashing. Press L2 or L3 until the correct number is showing. When the number is set at 0000.59, press R1.
5. Press R2 until UNITS is flashing. Select F (feet) using the R1 button.
6. Press R2 again and D (degrees) should be flashing. If not, press R1 to toggle on D.
7. Press R2 again and % should be flashing. It should say ON. If not, press R1.
8. Press R3 twice to accept the new settings and back out to the main display.

D. Filter and Reflectors

When you are working in areas of dense brush, you need to make sure the Laser is giving you the distance to the correct target. The best way to do this is to use a reflector as a target and use the filter option on the Laser. The Laser will only lock onto the highly reflective targets and ignore the less reflective brush. To use the filter option:

1. Place a reflector (or have someone hold it) on the tree where it can be seen from the required distance. The Laser will not work in the filter mode without a reflector as a target.
2. Go to the main menu on the Laser and push R2 or R3 until SYS is displayed on the screen.
3. Press R1 to select the SYS option. The FILTER option will blink, and it will say the FILTER is OFF or ON.
4. Push R1 to toggle FILTER between ON and OFF.
5. Press R3 to save the desired setting and to back out into the main display. When the FILTER is on, FILTER will appear at the bottom of the screen when the Laser is measuring distances.

E. Distances and % slope

Horizontal distance (HD): Turn the Laser on. The top-middle of the LCD screen will say HD. Point the red sighting dot at the target. Press R1 and hold it down until the Laser locks on the target, then release. You can tell when the instrument locks onto it's target by sound. It buzzes while it is searching for the target, then beeps when it locks on to a target or there is an error. If you get an error message, simply aim again and press R1.

Slope distance (SD) and Vertical distance (VD): Push R2 or R3 until the correct display is shown. Then aim and press R1 until the Laser locks on target. Or, measure a horizontal distance, then push R2 until the correct display is shown.

% slope: Press R2 or R3 until INC is displayed. Then aim and press R1.

F. Tree heights

The best way to measure a tree height is to make sure you have a clear shot at the leader or a clear shot of the tree trunk. Make sure you are getting a distance to the tree trunk, and not some branches in front of it. If you can't get a clear shot at the leader or the tree trunk, use a reflector (see section D). Once you are in position with your target in sight, go to the main menu:

1. Push R2 or R3 until HT is displayed in the upper left of the screen.

2. Push R1 once, aim at the target, then push R1 until the Laser locks on target. This will measure the horizontal distance.
3. The down arrow will flash. Aim at the top of the root collar and push R1 to get the % slope.
4. The up arrow will flash. Aim at the top of the tree and push R1 again to get another % slope.
5. Press R1 once more and the Laser will display the height. Make sure this height is reasonable before recording it in the Husky.

G. Gates

The gate option can extend the Laser's minimum range or restrict its maximum range. It is most often used to help you make sure you are hitting the right target when objects near you or just beyond your target might give you false readings. You don't have to set both gates. You will probably only need to set the short gate because of brush or fog between you and your target. You can set a gate by shooting a target or by entering distances into the instrument. To set a short gate by laser, go to the main menu and:

1. Press R2 or R3 until GATE is shown on the display.
2. Push R1 to select the gate option.
3. Press R1 to toggle the gate between ON and OFF.
4. Push R2. The S indicator will flash.
5. Aim at a target that is at the distance you want to set as the short gate and press R1.
6. Now you can either set a long gate, or press R3 to go back to save the short gate and return to the main menu. The S will be displayed when you are measuring distances to show the short gate is on.

To set a long gate:

7. Push R2. The L indicator will flash.
8. Aim at an appropriate target and press R1
9. Press R3 to save the gate and go back to the main display. The L will be displayed when measuring distances.

   The gates are reset to OFF when the Laser is turned off, but gate values are saved in memory. This means that if you have saved a gate and turn off the instrument, when you turn it back on the gate will be set to OFF. If you go back into the gate option and turn the gate ON, it will remember the last distances you shot for the long and short gates.

To clear out a gate value: Display the gate values by following the instructions in this section (section G). When the desired gate value is displayed, press and hold down R3 until the number is deleted.

H. Cumulative distances

A cumulative distance measurement allows you to move from one target point to the next, stopping at each one to measure the distance to the next target point. The Laser accumulates the measured distances in both slope and horizontal distances (SD and HD) to give you a running total.

To take a cumulative distance, go to the main menu and:

1. Press R2 or R3 until MULTI is displayed on the screen.
2. Press R1 to enter the MULTI option. DIFF will be displayed.

3. Press R2 once. CUM will be displayed.
4. Press R1. Either SEL or a number will be displayed. If SEL is displayed, HD will flash on and off. Press R1 to toggle between HD and SD. Press R2 when the correct indicator is flashing. If a number is displayed, that means there is already a cumulative distance saved on this instrument. You can either clear out this distance by holding down R3 until 0.00 appears, or continue to add to the distance by going to step 5.
5. Aim at the target and press R1 to fire the laser.
6. If you are not satisfied with the measurement, repeat step 5 to retake the measurement. If you are satisfied with the measurement, and wish to add it to your total, press R2. The new total will be displayed.
7. Repeat steps 5 and 6 to add more measurements to the total.

You can choose whether you want horizontal or slope distances at any time. If a distance has been measured, you can change from slope or horizontal distance by pressing R3 twice. SEL will be displayed. Push R1 to toggle between SD and HD. Press R2 twice to get back to the total distance. Go to step 5 to add more distances.

The cumulative measurement total is saved in memory even if the instrument is turned off. Turn the instrument on and scroll back to the MULTI-CUM option and resume the procedure with step 5. To clear out the current total and begin another series of measurements, hold down R3 while the cumulative distance is showing until the number is deleted.

APPENDIX 5 – SLOPE CORRECTION TABLE

PERCENT	EXPANSION FACTOR	EXPANSION FACTOR RECIPROCAL	--SLOPE DISTANCE-- 12.0 ft.	24.0 ft.	100 ft.	120.0 ft.
10	1.005	0.995	12.06	24.1	100.5	120.6
15	1.01	0.99	12.12	24.3	101.1	121.2
20	1.02	0.98	12.24	24.5	102	122.4
25	1.03	0.97	12.36	24.7	103.1	123.6
30	1.04	0.96	12.48	25.1	104.4	124.8
35	1.06	0.94	12.72	25.4	105.9	127.2
40	1.08	0.93	12.96	25.8	107.7	129.6
45	1.1	0.91	13.2	26.3	109.7	132
50	1.12	0.89	13.44	26.8	111.8	134.4
55	1.14	0.88	13.68	27.4	114.1	136.8
60	1.17	0.86	14.04	28	116.6	140.4
65	1.19	0.84	14.28	28.6	119.3	142.8
70	1.22	0.82	14.64	29.3	122.1	146.4
75	1.25	0.8	15	30	125	150
80	1.28	0.78	15.36	30.7	128.1	153.6
85	1.31	0.76	15.72	31.5	131.2	157.2
90	1.35	0.74	16.2	32.3	134.5	162
95	1.38	0.72	16.56	33.1	137.9	165.6
100	1.41	0.71	16.92	33.9	141.4	169.2
105	1.45	0.69	17.4	34.8	145	174
110	1.49	0.67	17.88	35.7	148.7	178.8
115	1.52	0.66	18.24	36.6	152.4	182.4
120	1.56	0.64	18.72	37.5	156.2	187.2
125	1.6	0.62	19.2	38.4	160.1	192
130	1.64	0.61	19.68	39.4	164	196.8
135	1.68	0.6	20.16	40.3	168	201.6
140	1.72	0.58	20.64	41.3	172	206.4
145	1.76	0.57	21.12	42.3	176.1	211.2
150	1.8	0.55	21.6	43.3	180.3	216
155	1.84	0.54	22.08	44.3	184.5	220.8

APPENDIX 6 – HAGLÖF VERTEX III USER GUIDE[2]

See complete Haglöf manual for additional information

SETUP
All settings to measure heights, distances and angles and BAF Factors are made in the SETUP menu. Choose between metric or feet, degree, gradients or percentage, pivot offset, transponder height (and manual distance).
Start the Vertex by pressing ON. Press any of the arrow keys and ON to go to settings. Step to the parameter using ON and change value with the arrow keys.

METRIC/FEET
Choose if height and distance values should be given in **METRIC or FEET**. Shift with the arrow keys and confirm your choice with ON.

DEG/GRAD/%
Select Angle unit as Deg (degrees), GRAD (gradients) or % (percentage) by pressing the arrow keys. Confirm by pressing ON.

P.OFFSET (Pivot Offset)
Change the value with the arrow keys and confirm your choice with ON.
"Pivot offset" is equal to the distance between the front side of the instrument to the aimed point where the prolonging of the sight line from the transponder and the top of the tree coincide. The imagined point is located somewhere behind your neck and the value should in normal cases be set to 1.0 feet.

T.HEIGHT (Transponder height)
Change the value with the arrow keys and confirm with ON. The value is set in meters.
T.HEIGHT is the height where the transponder is set, the reference height for the measuring unit. Normal breast height value is set to 4.5 ft.

M.DIST (Manual distance)
Change the value with the arrow keys and confirm with ON. The value is set in meters.
M.DIST is the manually measured (known) distance to the object to measure. Manual distance is used if measuring without transponder.

CALIBRATE
Use a measuring tape to measure the exact distance of 10.0 m (32.8 feet) between the transponder and the Vertex front. Press ON to start the Vertex instrument. Step in the menu to **CALIBRATE** and press ON. The instrument will calibrate to 10 m and automatically turn off when ready.
It is important to give the instrument approximately 10 minutes to set to the correct temperature before calibrating.

[2] Instructions copied from Vertex III and Transponder T3 manual v.1.4 eng, Haglöf Sweden AB 2005

DISPLAY CONTRAST

Set the display contrast for best possible visibility using the arrow keys.
Start the instrument with ON. Step to CONTRAST and press ON. Change the contrast with the arrow keys for best possible visibility.

CROSS HAIR SIGHT

Change the light in the cross sight by looking into the sight when measuring and using arrow keys to increase or decrease the light intensity.
If the sun (back-light) makes it difficult to see, use both eyes when aiming, and put a finger in front of the sight.

Horizontal Distance measuring (DME)

The Vertex can also be used as a horizontal distance measurer (DME). The display text will rotate 90º to simplify reading the results when measuring horizontal distances.
1. Press ON to start the Vertex and go with the arrow keys to **ANGLE** and push ON.
2. The Angle window is shown. Aim at the point where you need to know the angle. Push and press the ON until cross hair goes out. Read the obtained value in the display.
3. Push the left arrow key. The Vertex starts measuring the horizontal distance and the result is featured in the display.
Note that the angle is measured from the Vertex with the cross hair sight. This implies that it is not possible to use the outside of the Vertex to measure the angle of, for example a flat table surface.

Height measuring with transponder

Start the transponder and place it on/towards the object to measure. *Note that the transponder should be placed at the T.HEIGHT /(transponder height) that has been set in the settings menu.*
Walk a suitable distance from the object – for optimal results the distance equals the approximate height.
1. Press ON to start the Vertex and aim at the transponder. Keep pressing ON until the cross hair sight goes out momentarily. Now release ON. The Vertex has measured the distance, the angle and the horizontal distance to the transponder.
2. Aim at the height to measure with the sight cross blinking. Press ON until the cross hair disappears. The first height is locked and displayed. Repeat until all heights on the object are measured.

How to use the T3 Transponder

To perform any of the operations described below, keep the measuring unit loudspeaker towards the T3 loudspeaker.

Turn on Press meas.unit DME: trigger until 2 signals beep
Turn off Press meas.unit DME: trigger until 4 signals beep (transponder)
Signal Press meas.unit DME: trigger until signal stop/signal starts, app 10-15 sec.

APPENDIX 7 – ESTIMATING DBH WITH RELASKOP

The relaskop can be used to estimate diameters. The relaskop is only accurate if you are at a known horizontal distance of 33 ft., 66 ft, or 99 ft.

To accurately estimate a diameter, measure out to a horizontal distance of 33, 66, or 99 feet from the tree you want to measure. Look through the small window. The field of vision is divided into 2 halves, upper and lower, by a horizontal line that is the measuring edge. No other point of reading is accurate (see figure 61).

Figure 61

View the point on the tree where you want to estimate the diameter in the upper half. In the lower half you will see a series of bars and scales measuring up the edge (see Figure 61)

To take a reading, press the brake release button. The scale automatically rotates to the angle the instrument is tilted when sighting at the point of measurement. Partially release the brake button to help bring the scale to a faster stop.

The scale between “a” and “b” on Figure 62 is divided into 6 equal width bars (3 light and 3 dark).
The bars between “a” and “b” on the scale are equal to different diameters at different distances from the tree:

Each bar equals 2 inches at a horizontal distance of 33 feet
Each bar equals 4 inches at a horizontal distance of 66 feet
Each bar equals 6 inches at a horizontal distance of 99 feet

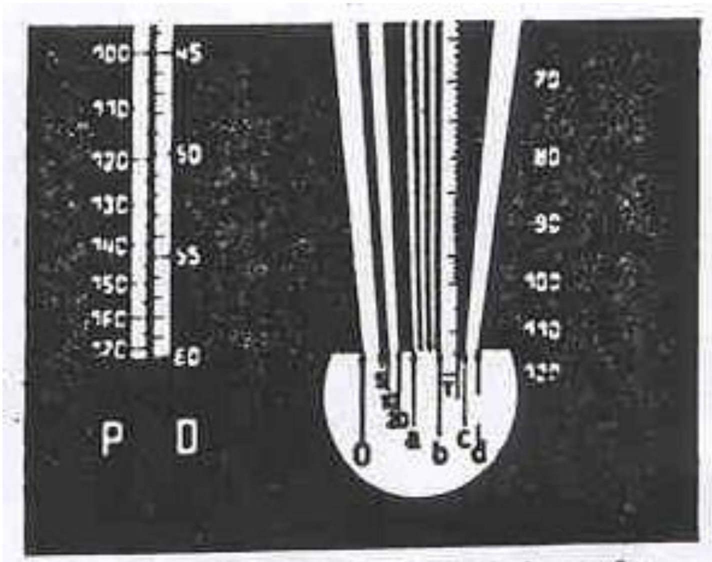


Fig. 50 Lower part of American scale, enlarged to show identification of graduations.

The distance between “0” and “10” on the scale equals the distance between “a” and “b”. At 33 feet, “a” to “b” represents 12 inches of diameter.
To measure a diameter of a tree with DBH of 34 inches, position the relaskop 33 feet from the tree and set the “0” edge of the scale on the left bark edge of the tree. Distance”0” to “10” will represent 12 inches of diameter; distance “10” to “a” will represent another 12 inches of diameter, , and the right bark edge will align with the right edge of the fifth bar between “a” and “b” for 10 more inches of diameter.
Total 12 + 12+ 10 = 34 inches DBH.

In this case the diameter can be read to the nearest 2 inches (and estimated to the nearest 1 inch)

By positioning the relaskop at other distances, such as 66 or 99 feet, different values apply

Since the instrument is self-adjusting for changes in slope, it follows that the diameter at any height above the ground can be estimated without correcting for slope. You still must correct for slope when measuring distance from the tree because all distances must be horizontal.

APPENDIX 8 - CRITERION RD 1000 USER GUIDE[3]

See complete Criterion RD 1000 manual for additional information

Diameter Mode

To acquire a direct read-out of the height and diameter of a tree at any point (or multiple points) along the stem from any convenient distance away:

1. Press the MODE button until the external LCD displays the DIAMETER Mode Indicator, the HD Measurement Prompt (flashing), the appropriate Units Indicator ("F" or "M"), and the EDIT Function Indicator. This is prompting you enter the horizontal distance to the target tree.

2. Enter the horizontal distance.

    Valid Values: 1.65 - 999.90 feet

    To automatically fill-in: Aim and fire your LTI laser range finder to download the measured HD value into the numeric display.

        The display will automatically advance to the next step.

    To manually enter: Measure the distance using a tape measure, press the EDIT button, and use the arrow buttons to edit the value.

        a. Press the UP or DOWN button to increase/decrease the value.

        b. Press the FWD or BACK button to move to next/previous digit.

        c. Press the ENTER button to accept the HD value.

    If you want to re-enter the horizontal distance (either manually or with a laser), press the BACK button and enter a new HD value.

3. The external LCD displays the DIAMETER Mode Indicator, the ANGLE Measurement Prompt Indicator (flashing), the DEG Units indicator, and the message “BASE” is prompting you to take the base angle measurement to the tree. This message is also displayed in the numeric area of the in-scope LED.

4. Looking through the sighting scope, press-and-hold the TRIGGER button to activate the illuminated in-scope LED Measurement Bar Scale.

5. Aim to the base of the target tree, and release the TRIGGER button to lock the inclination measurement. The inclination appears in both the in-scope LED and the external LCD, and is continuously updated as long as you hold the TRIGGER button.

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[3] Copied from Criterion RD 1000 User’s Manual, 2nd Edition, Laser Technology Inc, 2005

Upon release of the TRIGGER button, the in-scope LED flashes the locked inclination measurement.

6. Press-and-hold the TRIGGER button again and scan up the tree from the base. Release the Trigger button at any given tree height to lock the inclination measurement, for example 4.5 feet.

While you are tracking up the tree stem, the tree height is dynamically updated in both the in-scope LED and the external LCD.

When you release the TRIGGER button, the tree diameter is shown in both the in-scope LED and the external LCD. This value is based upon the width of the illuminated in-scope LED Measurement Scale.

Now use the SCALE ADJUST (+) AND (-) buttons to align the edges of the bar scale with the edges of the target tree, simultaneously changing the displayed diameter value.

APPENDIX 9 – MEASURING HEIGHTS USING A CLINOMETER

Tree heights can be measured using a clinometer and a measuring tape. The clinometer is only accurate if you use the HORIZONTAL DISTANCE from you to the tree when measuring a tree height.

To calculate a tree height, walk away from the tree and find a spot at least 1 tree length away where you can see both the top of the tree and the top of the root collar. If the tree is 50 feet tall, then you need to be at least 50 feet away from the tree when you measure the height.

Walk uphill of the tree when measuring a height if possible. It is easier to see both the top of the tree and the top of the root collar if you are up hill of it. Also, you do not have to walk as far away from the tree if you go uphill.

Look through your clinometer with one eye, and keep the other eye open. Keep both eyes open, and look up until the top of the tree is even with the horizontal line in the center of the clinometer. When the horizontal line in the clinometer is even with the top of the tree, read the number on the % (percent) scale of the clinometer that is touching the horizontal line in the clinometer. The % scale is usually on the right side on the inside of the clinometer. If you are unsure which scale to use, look into the clinometer and then tilt the clinometer up or down until the % symbol is visible on the scale.

Make sure you are far enough away from the tree so that your reading is not over 120%. The clinometer is not accurate when readings above 120% are used.

Now look through the clinometer with both eyes open and tilt the clinometer down until the horizontal line in the clinometer is even with the top of the root collar. Read the number on the % scale that is touching the horizontal line in the clinometer.

The % scale of the clinometer is divided into 1% increments from 0 to + or – 70%. The distance between each small tic mark on the scale is equal to 1%. From + or – 70% and greater, the scale is divided into 2% increments. The distance between each small tic mark on this part of the scale is equal to 2%.

Most of the time you will read a positive number (+) while looking at the top of the tree, and a negative number (-) while looking at the top of the root collar. ADD the number you observed while looking at the top of the tree with the number you observed while looking at the top of the root collar. This gives you Total Percent.

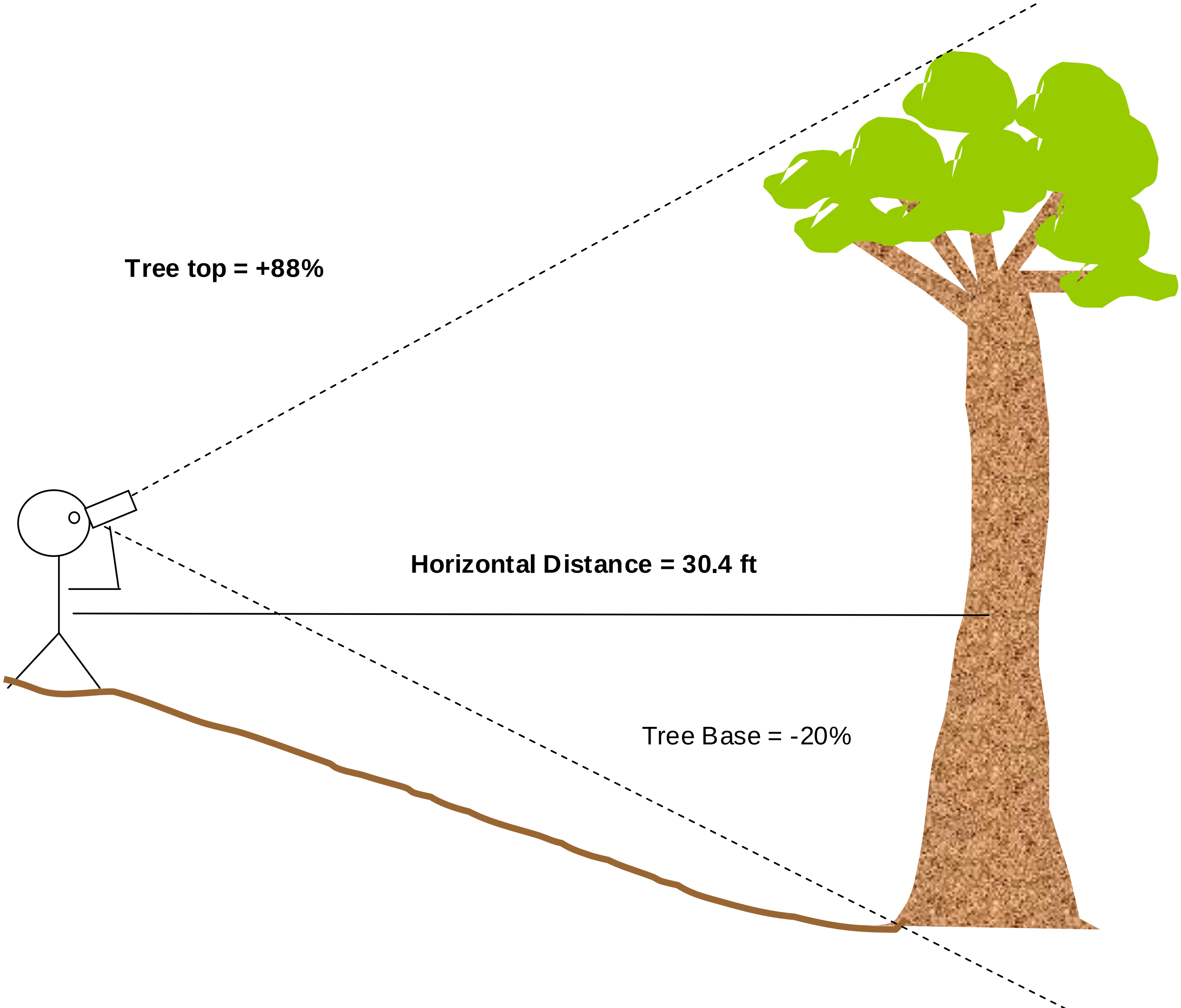
Special Case:
If you have to go down hill or very far uphill, you may read in your clinometer that both the top of the tree and the top of the root collar are positive numbers on the % scale. Or you may have both the top of the tree and the top of the root collar are negative numbers. If the top of the tree and the top of the root collar are the same sign (either

both are positive or both are negative) on the clinometer % scale, then SUBTRACT the tree top number and the root collar number. This gives Total Percent.

Measure the horizontal distance between where you took the readings with the clinometer and the tree. If you went up or down a hill to measure the height, then you must calculate the horizontal distance (see next page)

Multiply the Total Percent for your tree times the horizontal distance you just measured or calculated. Then divide this number by 100. This number is the height of your tree.

Example:



To calculate the height of this tree:

$$\frac{(\%\ \text{Tree top}) + \text{or} - (\%\ \text{Root Collar}) * (\text{Horizontal Distance})}{100\%}$$

88% + 20% = 108% (these 2 numbers are added, since tree top % is positive and root collar % is negative)

108% * 30.4 feet = 3283.2

3283.2 / 100% = **32.8 feet is the height of this tree**

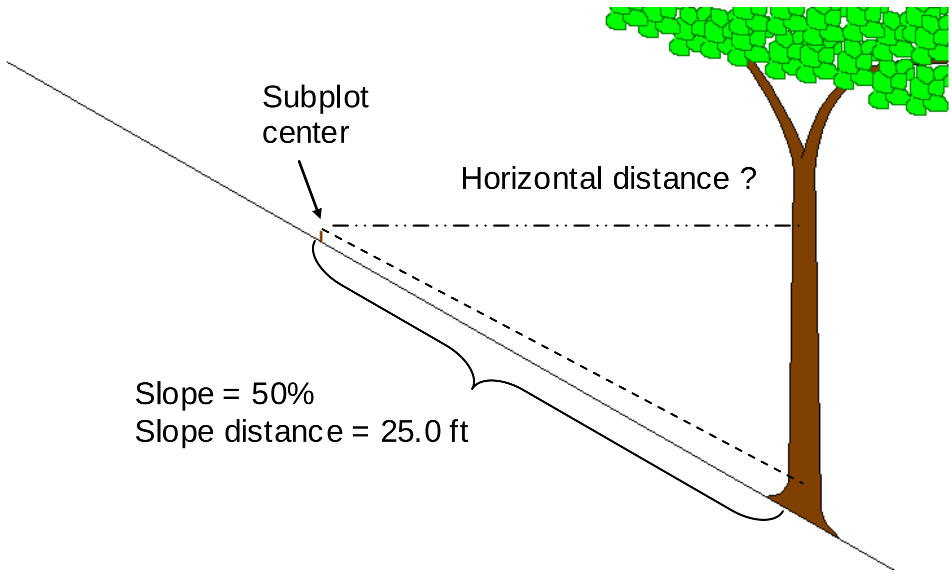
APPENDIX 10 – CALCULATING HORIZONTAL DISTANCE

When horizontal distance cannot be accurately measured it can be calculated by using percent slope, slope distance, and a slope correction table.

To calculate horizontal distance, first measure the slope distance.
Then use your clinometer to get a % slope. You should measure the % slope of the measuring tape. The clinometer should be at the level of your slope distance measuring tape.
Use the Slope Correction Table (see page 261) to look up the expansion factor reciprocal for the % slope of the measuring tape.
Multiply the expansion factor reciprocal by the slope distance you measured.
This gives you the horizontal distance.

The horizontal distance will always be less than the slope distance.

Example:



What is the horizontal distance from subplot center to this tree?

Expansion Factor Reciprocal for 50% slope = .89

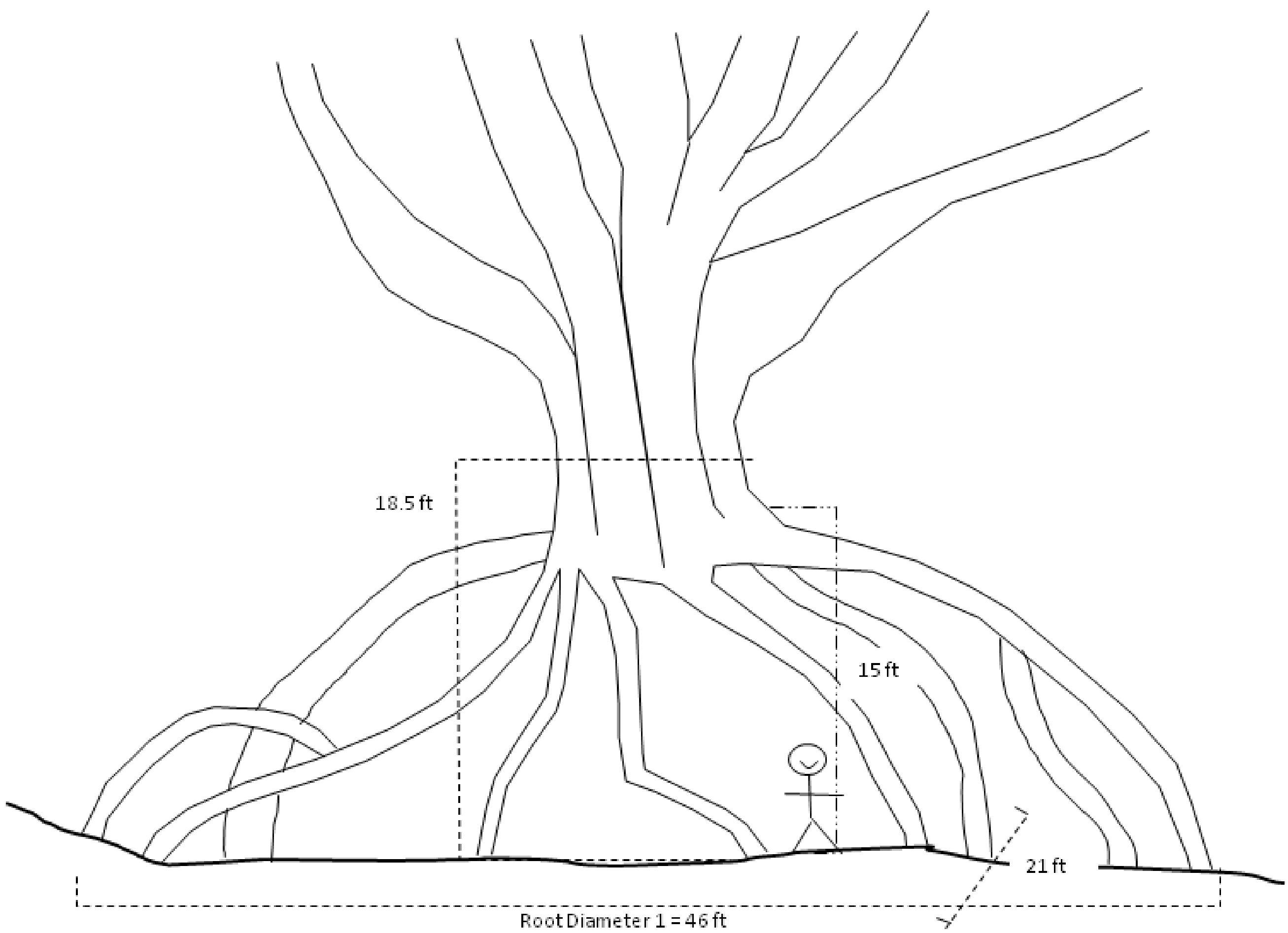
.89 * 25.0 = 22.25 feet

The horizontal distance is 22.25 feet. This tree is within 24.0 feet of subplot center and is over 5.0 inches dbh, so it will qualify as a tally tree.

Slope distance = Horizontal distance when % Slope = 0

APPENDIX 11 – EXAMPLE OF BANYAN TREE MEASUREMENTS

For trees with roots tall enough where it is unreasonable to measure dbh:
Estimate one dbh, even if the tree is forked below 4.5 feet above the roots
Height to dbh = 18.5 feet (3.5 feet above top of root collar)
Diameter is estimated with a relaskop, so Diameter Check = 1
Rooting height is 15 feet.
Type of rooting system = 1
Root diameter 1 = 46 feet
Root diameter 2 = 21 feet
Prop root density = 1
Aerial root density = 0
Branching characteristics = 4



APPENDIX 12 – DETERMINING SCALES AND BASELINES FROM A MAP OR PHOTO

Determining scale measuring object of known size on map or photo

First you must measure the length of an object on the map or photo whose actual length you know. This might be a football field, a city block, or a section of a road. You need to go out to the location mapped or pictured and measure the distance between two identifiable objects.
Once you have the two distances, you can find the scale

For example, suppose you have a photo and you need to determine the scale of the photo. Find 2 points on the ground that are visible on the photo and are easy to identify on the ground. Road intersections usually work well because they are usually easy to find on the photos and on the ground. Measure the horizontal distance between these 2 points on the ground (ground distance). Then measure the distance between the 2 points on the photo (photo distance).

If the distance between the 2 points is **1,200 feet** ground distance, and **.4 inches** photo distance, then the scale of the photos is calculated:

$$\frac{1{,}300 \text{ feet ground distance}}{.4 \text{ inches photo distance}} * \frac{12 \text{ inches}}{1 \text{ foot}} = \frac{(1{,}300 * 12)}{.4} = \frac{15{,}600 \text{ ground}}{.4 \text{ map}} = \mathbf{1:39{,}000}$$

This means that 1 inch on the photo is equal to 39,000 inches on the ground. Since 1 foot = 12 inches, then 39,000 inches/ 12 feet = 3,250 feet. Therefore, each inch on the photo is equal to 3,250 feet on the ground.

One exception for aerial photos is that this method assumes the two locations are at the same elevation--or that the terrain is flat. If you are using aerial photos, the terrain may not be flat. If there are hills, even moderate ones, the calculations can be thrown off. Try to measure the distance between 2 points on the ground that are similar in elevation.

Determining scale by comparing with another map or photo of known scale

Another way to calculate scale on an unknown map or photo is to compare it to a map with a known scale. For example, suppose you have an aerial photo where the distance between two hills is **3.12 inches**. You have a map of the same area at **1:24,000**, and on the map the distance between the hills is **1.3 inches**. The answer involves a little algebra. Since the ground distance is the same on both photo and map, we can create an expression for this ground distance for both, and then put them on either side of an equation. The ground distance can be found by multiplying the map/photo distance by the scale (in this case, by the inverse of the scale--notice how this makes the units cancel correctly). We need to find, for the photo, how many ground units are represented by one unit on the photo, so we use an *x* for this unknown quantity and solve for it:

$$3.12 \text{ in photo} * \frac{x \text{ ground}}{1 \text{ photo}} = 1.3 \text{ in map} * \frac{24{,}000 \text{ ground}}{1 \text{ map}} \text{ ; and}$$

$$3.12 \text{ in} * x \text{ ground} = 1.3 \text{ in} * 24{,}000 \text{ ground}$$

$$x = \frac{1.3 \text{ in} * 24{,}000}{3.12 \text{ in}} = 10{,}000$$

The scale for the photo is 1:10,000

Calculating a baseline on a map or photo

A baseline is often used in thick jungle where gps coordinates are difficult to obtain and/or navigation by using maps and aerial photography is difficult. A baseline is used to measure an azimuth and distance from a known point to the plot center. To calculate a baseline:

1. Determine the scale of the map or photo.
2. Measure the photo or map distance from a point of departure to the plot center. The point of departure is a know location that can be identified on the map or photo and can also be identified on the ground (a tree, intersection, house, etc)..
3. Calculate the ground distance using the photo or map scale and the photo or map distance.

For example:
The photo scale is 1:12,000
The photo distance from the corner of a house to the plot center is 1.13 inches. The house must be visible on the photo and identified on the ground.

$$1.13 \text{ inches photo} * \frac{12{,}000 \text{ ground}}{1 \text{ photo}} = 13{,}560 \text{ inches ground distance}$$

$$13{,}560 \text{ inches} * \frac{1 \text{ foot}}{12 \text{ inches}} = 1{,}130 \text{ feet ground distance}$$

Therefore, you must measure 1,130 feet from the corner of the house to arrive at plot center.

The azimuth from the house to the plot center can be calculated by:

1) Measure the azimuth between two points that are visible on the photos and the ground. Straight-line sections of road or powerlines often work well for determining baselines. Shoot the azimuth down one side of the road.
2) Draw a line in pencil on the photo between the 2 points you just measured the azimuth between. Extend this line as far as necessary.
3) Find a place that can be identified on the ground and the photo from which you can measure azimuth and distance to find plot center. This is your point of departure. Draw

a line between plot center and the point of departure. This is your baseline. Extend this line as far as necessary so that it intersects the line drawn previously in number 2.

4) Calculate the azimuth from the known point of departure and the plot center using a protractor and the line drawn in number 2.

Adapted from Bryan Baker, Sonoma State University, Principles of map scale, www.sonoma.edu/GIC/Geographica/Mapinterp/Scale.htm, January, 1999

APPENDIX 13 – DATA SHEETS

Plot Number ________ Year____ Month____ Day____

PLOT LEVEL DATA

STATE	
ISLAND	
COUNTY	
P2 VEG SAMP STATUS	
SURV GRD GPS COORD. COLLCTD	
DECLINATION	
QA STATUS	
CREW NUMBER (1-5)	
PLOT STATUS	
NONFOREST SAMPLING STATUS	
NONFOREST PLOT STATUS	
PLOT NONSAMP RSN	
NONFOR PLOT NONSAMP RSN	
SUBPLOTS EXAMINED	
SAMPLE KIND	
SAMPLE METHOD CODE	
PREVIOUS PLOT NUMBER	
TRAILS OR ROADS	
HOR. DIST TO IMP ROAD	
ROAD ACCESS	
PUBLIC USE RESTRICTIONS	
RECREATION USE 1	
RECREATION USE 2	
RECREATION USE 3	
WATER ON PLOT	
LANDOWNER PLOT SUM REQ	
Plot Notes:	
RP TYPE	
RP SPECIES	
RP DIAMETER	
RP AZIMUTH	
RP HOR DIST	
RP AZM/DIST TO SUBPLOT NUMBER	
RP Notes:	

Plot Number ________ Year____ Month____ Day____

UTM Zone: ____

GPS DATA

Handheld GPS Record 1

UNIT TYPE	SERIAL/UNIT #	GPS LOCATION TYPE:
EASTING:	NORTHING:	ELEVATION
ERROR:	READINGS:	
AZM TO CENTER:	DIST TO CENTER:	

GPS Note:

Handheld GPS Record 2

UNIT TYPE	SERIAL/UNIT #	GPS LOCATION TYPE:
EASTING:	NORTHING:	ELEVATION
ERROR:	READINGS:	
AZM TO CENTER:	DIST TO CENTER:	

GPS Note:

Handheld GPS Record 3

UNIT TYPE	SERIAL/UNIT #	GPS LOCATION TYPE:
EASTING:	NORTHING:	ELEVATION
ERROR:	READINGS:	
AZM TO CENTER:	DIST TO CENTER:	

GPS Note:

Handheld GPS Record 4

UNIT TYPE	SERIAL/UNIT #	GPS LOCATION TYPE:
EASTING:	NORTHING:	ELEVATION
ERROR:	READINGS:	
AZM TO CENTER:	DIST TO CENTER:	

GPS Note:

Handheld GPS Record 5

UNIT TYPE	SERIAL/UNIT #	GPS LOCATION TYPE:
EASTING:	NORTHING:	ELEVATION
ERROR:	READINGS:	
AZM TO CENTER:	DIST TO CENTER:	

GPS Note:

Plot Number ________

GPS DATA cont'd

Survey Grade GPS – Subplot 1

UNIT TYPE: **3**	SERIAL/UNIT #	GPS LOCATION TYPE: **15**
ANTENNA HT:	TIME REC STARTED:	TIME REC STOPPED **:**
AZM TO CENTER:	DIST TO CENTER:	CREW NUMBER
YEAR	MONTH	DAY

GPS Note:

Survey Grade GPS – Subplot 2

UNIT TYPE: **3**	SERIAL/UNIT #	GPS LOCATION TYPE: **16**
ANTENNA HT:	TIME REC STARTED:	TIME REC STOPPED **:**
AZM TO CENTER:	DIST TO CENTER:	CREW NUMBER
YEAR	MONTH	DAY

GPS Note:

Survey Grade GPS – Subplot 3

UNIT TYPE: **3**	SERIAL/UNIT #	GPS LOCATION TYPE: **17**
ANTENNA HT:	TIME REC STARTED:	TIME REC STOPPED **:**
AZM TO CENTER:	DIST TO CENTER:	CREW NUMBER
YEAR	MONTH	DAY

GPS Note:

Survey Grade GPS – Subplot 4

UNIT TYPE: **3**	SERIAL/UNIT #	GPS LOCATION TYPE: **18**
ANTENNA HT:	TIME REC STARTED:	TIME REC STOPPED **:**
AZM TO CENTER:	DIST TO CENTER:	CREW NUMBER
YEAR	MONTH	DAY

GPS Note:

Plot Number ________ Year____ Month____ Day____

CONDITON CLASS DATA

CONDITION CLASS NUMBER	1	2	3	4	5
CONDITION CLASS STATUS					
NONFOREST CONDITION CLASS STATUS					
NONFOREST CONDITION NONSAMP RSN					
NONFOREST COND CLASS SAMP STAT					
RESERVED STATUS					
OWNER GROUP					
FOREST COMMUNITY					
STAND SIZE CLASS					
REGENERATION STATUS					
TREE DENSITY					
OWNER CLASS					
PRIVATE OWNER INDUSTRIAL STATUS					
ARTIFICIAL REGENERATION SPECIES					
STAND AGE					
DOMINANT TREE SPECIES 1					
DOMINANT TREE SPECIES 2					
DOMINANT TREE SPECIES 3					
DISTURBANCE 1					
DISTURBANCE YEAR 1					
DISTURBANCE 2					
DISTURBANCE YEAR 2					
DISTURBANCE 3					
DISTURBANCE YEAR 3					
TREATMENT 1					
TREATMENT YEAR 1					
TREATMENT 2					
TREATMENT YEAR 2					
TREATMENT 3					
TREATMENT YEAR 3					
CONDITION CLASS SLOPE					
CONDITION CLASS ASPECT					
PHYSIOGRAPHIC CLASS					
SLOPE SHAPE					
SLOPE POSITION					
PRESENT NONFOREST LAND USE					
CANOPY COVER SAMPLE METHOD					
LIVE CANOPY COVER					
LIVE PLUS MISSING CANOPY COVER					
TOTAL STEMS					
CONDITION NONSAMP RSN					

Condition Class Notes:

Plot Number ________ Year____ Month____ Day____

SUBPLOT DATA

SUBPLOT NUMBER	1	2	3	4
SUBPLOT STATUS				
SUBPLOT NONSAMP RSN				
NONFOREST SUBPLOT STATUS				
NONFOREST SUBPLOT NONSAMP RSN				
SUBPLOT CENTER COND				
SUBPLOT CENTER COND CLASS STAT CHANGE				
SUBPLOT CONDITION LIST				
MICROPLOT CENTER CONDITION				
SUBPLOT SLOPE				
SUBPLOT ASPECT				
SLOPE SHAPE				
SLOPE POSITION				
SNOW/WATER DEPTH				
PERCENT OF PIG DAMAGE (condition 1)				
PERCENT OF PIG DAMAGE (condition 2)				
PERCENT OF PIG DAMAGE (condition 3)				
P2 VEG SUBPLOT SAMP STATUS				
VEG NONSAMP RSN				
INVASIVE PLANT SUBPLOT STATUS				
INVASIVE PLANT NONSAMP RSN				
HIGH TALLY SAPLING PROCEDURES				

Subplot Notes:

MAPPING/BOUNDARY DATA

SUBPLOT #	PLOT TYPE	BOUNDARY CHANGE	CONTRASTING CONDITION	LEFT AZIMUTH	CORNER AZIMUTH	CORNER DISTANCE	RIGHT AZIMUTH

Boundary Notes:

Plot Number ________ Year____ Month____ Day____

SEEDLING COUNT

SPECIES	CC #	SUBPLOT 1 COUNT	CC #	SUBPLOT 2 COUNT	CC #	SUBPLOT 3 COUNT	CC #	SUBPLOT 4 COUNT

Seedling Notes:

Plot Number ________ Year____ Month____ Day____

P2 VEGETATION PROFILE DATA

(status and level of detail) NOTE: Separate sheet for each subplot/condition pair.

Subplot:__	Sbpt_Samp_Status: __	VEG_NS_Reason*:__	Cond_Num: __

Notes:

*: 04 – Time limitation; 05 – Lost data; 10 – Other

Vegetation Structure

VS Growth Habit	% COV Layer 1	% COV Layer 2	% COV Layer3	% COV Layer 4	% COV Total
Tally Trees					
Non-Tally Trees					
Shrubs/Wdy Vines					
Forbs					
Graminoids					
Moss/Bryophyte					

Species composition

Species Growth Habit	SPCD	Unique SP	Sp Notes	Specimen Collected?			
				Label Number	Not Collected Reason	% Cover	Layer
Seedling /sapling							
Shrubs/ woody vines							
Forbs							
Grass-like							

Specimen non-collected reasons:

01 – Species locally sparse
02 – No mature foliage or reproductive parts present
03 – Hazardous situation
04 – Time limitation
05 – Plant collection not allowed
06 – Collected for immediate / local id
07 – Not required by unit
10 – Other

Vegetation Specimen Label Community Description notes:

Plot Number ________ Date____________

INVASIVE PLANTS DATA

SUBPLOT #	CONDITION CLASS #	SPECIES	UNIQUE SPECIES #	SPECIES CANOPY COVER	INVASIVE SPECIMEN COLLECTED	SPECIMEN LABEL #	INVASIVE PLANT NOTES

Invasive Plant Data Notes:

TREE & SAPLING DATA Plot Number ________ Date____________

SUBPLOT NUMBER																			
TREE RECORD #																			
TREE TAG #																			
PREV TAG #																			
CONDITION CLASS #																			
PREV STATUS																			
PRESENT STATUS																			
WITNESS																			
STANDING DEAD																			
LEAN ANGLE																			
RECONCILE																			
SPECIES																			
AZIMUTH																			
HOR. DIST																			
SLOPE DIST																			
PREV DIAMETER																			
DIAMETER																			
DIAMETER CHECK																			
LENGTH TO CENTROID DIA																			
ACTUAL LENGTH TO CENTROID DIA																			
CENTROID DIA UPPER BOLE																			
BRANCHING CHARACT.																			
TYPE OF ROOTING SYS																			
ROOT DIAMETER 1																			
ROOT DIAMETER 2																			
ROOTING HEIGHT																			
PROP ROOT DENSITY																			
# OF BUTTRESSES																			
AERIAL ROOT DENSITY																			
ACTUAL LENGTH																			
TOTAL LENGTH																			
LENGTH METHOD																			
UNCOMP LIVE CROWN																			
COMPACTED LIVE CROWN																			
CROWN CLASS																			
DAMAGE LOC 1																			
DAMAGE TYPE 1																			
DAMAGE SEV 1																			
DAMAGING AGENT 1																			
DAMAGE LOC 2																			
DAMAGE TYPE 2																			
DAMAGE SEV 2																			
DAMAGING AGENT 2																			
DECAY CLASS																			
EPIPHYTE LOADING																			
CLUMP CODE																			
PRIORITY DAMAGE																			
PRIORITY DAMAGE SEV																			
ROT/MISS CULL																			
CAUSE OF DEATH																			
TREE NOTES																			

APPENDIX 14 – METRIC EQUIVALENTS AND AIDS

Length

1 inch	=	2.54 centimeters (cm.)
0.1 feet	=	3.048 centimeters (cm.)
1 foot	=	0.3048 meter (m.)
1 mile	=	1.609 kilometers (km.)

1 centimeter (cm.)	=	.03 foot (ft.)
1 meter (m.)	=	3.2808 feet (ft.)

Area

1 acre	=	0.4 hectare (ha.) (approximately)
5 acres	=	2 hectares (ha.) (approximately)
1,000 acres	=	404.7 hectares (ha.)
1 hectare	=	2.471 acres (ac.)
2.5 hectares	=	6 acres (ac.) (approximately)

Volume

1,000 cubic feet	=	28.3 meters (m^3)
1 cubic foot per acre	=	0.07 cubic meter per hectare (m^3/ha)

Condition class minimum area

0.4 hectares (1 acre)	=	4,000 square meters
	=	40 meters x 100 meters
	=	35 meter radius circle

1 acre	=	118 foot radius circle
	=	209 feet x 209 feet
	=	43,560 square feet

Metric System-length

1 meter	=	10 decimeters (dm.)
1 meter	=	100 centimeters (cm.)
1 meter	=	1,000 millimeters (mm.)

and:

.001 meters	=	1 millimeter
.01 meters	=	1 centimeter
.1 meters	=	1 decimeter
1 meter	=	1 meter
10 meters	=	1 decameter
100 meters	=	1 hectometer
1,000 meters	=	1 kilometer

Photo Scales

Scale	Length on Photo	Length on Ground
1:15,840	1 mm.	15.8 meters
1:24,000	1 mm.	24.0 meters
1:31,680	1 mm.	31.7 meters
1:40,000	1 mm.	40.0 meters
1:15,840	1 inch	1,320 feet
	0.1 inch	132 feet
	.05 inch (1/20)	66 feet
1:24,000	1 inch	2,000 feet
	0.1 inch	200 feet
	.05 inch (1/20)	100 feet
1:31,680	1 inch	2,640 feet
	0.1 inch	264 feet
	.05 inch (1/20)	132 feet
1:40,000	1 inch	3,333 feet
	0.1 inch	333 feet
	.05 inch (1/20)	166 feet

APPENDIX 15 – LANDOWNER CONTACT LETTER

United States Department of Agriculture | **Forest Service** | **Pacific Northwest Research Station** | **Anchorage Forestry Sciences Lab**
3301 C Street, Suite 200
Anchorage, AK 99503
(907) 743-9414

File Code: 4810

Date: Winter 2012

To Whom It May Concern:

Hello, we are researchers from the USDA Forest Service, Pacific Northwest Research Station. We are obtaining information on the forest resources of the Pacific Northwest from measurements taken on a large number of randomly located sample plots on forestland. We are visiting one of these plots in this general vicinity today.

We locate each plot from a sample selected on an aerial photograph. While at the site we record information pertaining to the type of terrain; tree species, heights, and diameters; insect and disease damage; mortality and regeneration; and the amount and kind of understory vegetation. Many of our field plots were first established in the early 1960's and have been revisited on a 10-year cycle.

With the measurements we take, analysts will develop basic information about the amount, condition, and change in the area's forest resource. Published reports contain data on forest land area and ownership, timber volume, forest growth, mortality and cut, potential productivity, and opportunities for silvicultural treatment.

If you are interested in learning more about our research plans, or care to see publications from previous inventories similar to this one, please contact Ray Koleser at (907) 748-9416 by telephone or by writing to:

Anchorage Forestry Sciences Laboratory
Forest Inventory and Analysis Program
3301 C Street
Suite 200
Anchorage, AK 99503

Sincerely,

Ray Koleser
Alaska Data Collection Team Leader
Forest Inventory and Analysis

APPENDIX 16 – HELLO LETTER/DATA CONFIDENTIALITY

United States Department of Agriculture **Forest Service** **Pacific Northwest Research Station**

Forestry Sciences Lab
P.O. Box 3890
Portland, Oregon 97208
(503) 808-2000

File Code: 4810
Date:

«OWN_NAME»
«ADDRESS_LINE_1»
«ADDRESS_LINE_2»
«ADDRESS_LINE_3»

Dear«OWN_NAME»

The Pacific Northwest Research Station is continuing to collect basic information about forest resources in Hawaii. The Forest Inventory and Analysis (FIA) Program at the station participates in a national effort to evaluate the status and condition of our nations forest ecosystems. Data is collected on FIA field plots so that we can determine the amount, condition and trends of Hawaii forested resources. The data will also allow us to detect and understand changes in local and regional forest health.

Data we collect from the field plot(s) on your property are combined with other plot data from adjoining areas and counties to provide information about resource conditions in the state of Hawaii. The data will not be identified in any way with your name or property and will have no bearing on your property taxes. Collected data are summarized, analyzed, and published in statistical and analytical reports for the United States, for Hawaii alone, and for various geographic areas within Hawaii and are available to the public.

Our records show that this year there is a field plot(s) that falls on your land. We request your permission to access your land to measure the trees and the vegetation on this plot. We only request your permission to access your land. We do not ask you to change your management practices, nor will our measurements affect any ongoing or planned activities for this site.

Our field staff will be in your area between January and October 2012. If you wish, they will contact you before entering your land. We realize that working on your land is a privilege and we will respect your landowner rights at all times. We are prepared to honor any special conditions that you may require of us. Enclosed is a reply postcard for your response and any concerns, such as locked gates or other access problems. If you have any questions regarding this letter or pertaining to this inventory, please feel free to contact Ray Koleser at (907) 748-9416 or rkoleser@fs.fed.us.

We will be happy to share the resource information we gather from your property should you be interested. Thank you again for your cooperation in this study. Your participation is greatly appreciated.

Charley Peterson
Program Manager
Forest inventory and Analysis

Enclosure
County (**«COUNTYNTYCODE»**) Plot (**«PLOT»**)

United States Department of Agriculture **Forest Service** **Pacific Northwest Research Station** **Forestry Sciences Laboratory**
P.O. Box 3890
Portland, Oregon 97208
(503) 808-2000

File Code: 4810

Date:

R E L E A S E

The USDA FOREST SERVICE assumes liability, pursuant to the Federal Tort Claims Act, for any damages caused by negligence of Forest Service personnel while upon the landowner's property in connection with the inventory of forest resources in the State of Hawaii, and the landowner shall not be liable for injuries occurring to Forest Service personnel for any reason except the negligent or wrongful acts of the landowner while they are on the property owned or controlled by the landowner.

County __________________________

Plot Number __________________________

Landowner __________________________

Charley Peterson
Program Manager
Forest Inventory and Analysis
Pacific Northwest Research Station
US Department of Agriculture

APPENDIX 17 – VARIANCE PLOTS

A. Objectives: Variance plots are performed for several purposes:

1. To assess the range of values for collected data;

2. To ensure that documented field plot instructions and accuracy standards are uniformly understood and consistently followed;

3. To assess the ability of individual crew members.

B. Variance plot policies: The following policies for conducting variance plots will be followed:

1. Each person will be checked within the first two weeks of field work and will accompany the variance-plotter to the variance plot.

2. Variance plots will continue during the entire season; each person is assessed multiple times throughout the field season.

3. All variance plot items count equally for each person who did the plot.

C. Types of variance plots:

Hot Variance - an informal inspection done as part of the training process. The inspector is present on the plot with the trainee and provides immediate feedback regarding data quality. Data errors are corrected. Hot variances can be done on test plots or production plots.

Cold Variance - a formal or informal inspection done either as part of the training process, or as part of an ongoing QC program. The inspector re-measures completed work after a crew has turned it in. Data errors are corrected. Cold variances are done on production plots only.

Blind Variance - a formal inspection done without crew data on hand; a full re-installation of the plot for the purpose of obtaining a measure of data variance. The two data sets are maintained separately. Data are NOT corrected. Blind variances are done on production plots only.

D. Variance plot procedures:

1. In the field, the variance plotter checks all tree classifications and measurements. The variance plotter or one of the crew members who originally did the plot makes all of the tree measurements during the variance plot visit. These variance measurements are compared to the original measurements recorded on the data recorder hardcopy for hot and cold variance plots. Items that do not meet accuracy standards are rechecked. Final decisions on accuracy rest with the variance plotter. Errors are circled in red on the original tally sheet, and the correct value written near the circle.

Blind variance plots are recorded as a new plot without any reference to prior measurement. New data sheets are used and the plots are designated as blind variance

2. Completing the variance plot form. Field plot items on the variance plot form are organized into categories based on what the items are related to. Each category is given a percentage rating based on the amount of items correct. The grading procedures give weights differently to items depending on the item's importance.

APPENDIX 18 – GLOSSARY

ACCESSIBLE FOREST LAND LAND THAT IS WITHIN SAMPLED AREA (THE POPULATION OF INTEREST), IS ACCESSIBLE AND CAN SAFELY BE VISITED, AND MEETS THE FOLLOWING CRITERIA: THE CONDITION HAS AT LEAST 10 PERCENT CROWN COVER BY TREES OF ANY SIZE, OR HAS HAD AT LEAST 10 PERCENT COVER IN THE PAST. ADDITIONALLY, THE CONDITION IS NOT SUBJECT TO NONFOREST USE THAT PREVENTS NORMAL REGENERATION AND SUCCESSION SUCH AS REGULAR MOWING, GRAZING, OR RECREATION ACTIVITIES

ACRE: A UNIT OF LAND CONTAINING 43,560 SQUARE FEET OF AREA.

AGE AT BREAST-HIGH THE NUMBER OF ANNUAL GROWTH RINGS BETWEEN THE BARK AND THE CENTER OF THE TREE AT 4.5 FEET ABOVE THE ROOT COLLAR ON THE BOLE OF A TREE.

AGRICULTURAL LAND LAND MANAGED FOR CROPS, PASTURE, OR OTHER AGRICULTURAL USE. EVIDENCE INCLUDES GEOMETRIC FIELD AND ROAD PATTERNS, FENCING, AND THE TRACES PRODUCED BY LIVESTOCK OR MECHANIZED EUQIPMENT. THE ARE MUST BE AT LEAST 1.0 ACRE IN SIZE AND 120.0 FT WIDE AT THE POINT OF OCCURANCE

ASPECT THE DIRECTION A SLOPE FACES.

AZIMUTH: ANGLE OR DIRECTION FROM 1 TO 360 DEGREES. THE AZIMUTH PLUS 180 DEGREES IS THE BACK AZIMUTH.

BASAL AREA: (A) OF A TREE: THE CROSS SECTIONAL AREA OF A TREE AT BREAST HEIGHT ON THE STEM. (B) OF A FOREST OR STAND: THE CROSS-SECTIONAL AREA AT BREAST HEIGHT OF ALL TREES WITHIN A UNIT OF AREA.

BASAL AREA FACTOR (BAF): THE BASAL AREA PER UNIT OF AREA CORRESPONDING WITH A GIVEN CRITICAL ANGLE IN VARIABLE-RADIUS PLOT SAMPLING.

BLIND VARIANCE A RE-INSTALLATION DONE BY A QUALIFIED INSPECTION CREW WITHOUT PRODUCTION CREW DATA ON HAND; A FULL RE-INSTALLATION OF THE PLOT FOR THE PURPOSE OF OBTAINING A MEASURE OF DATA QUALITY. THE TWO DATA SETS ARE MAINTAINED SEPARATELY. DISCREPANCIES BETWEEN THE TWO SETS OF DATA ARE NOT RECONCILED. BLIND VARIANCES ARE DONE ON PRODUCTION PLOTS ONLY.

BOLE: TRUNK OR MAIN STEM OF A TREE.

BORDERLINE TREE:	A TREE THAT IS AT OR NEARLY AT THE LIMITING DISTANCE ASSOCIATED WITH A GIVEN BASAL AREA FACTOR. BORDERLINE TREES REQUIRED PRECISE CHECKING TO DETERMINE IF THEY ARE TO BE SAMPLED.
BREAST HEIGHT:	THE STANDARD HEIGHT, 4.5 FEET ABOVE GROUND LEVEL, AT WHICH DIAMETER OF A STANDING TREE OR SNAG IS MEASURED. ON SLOPING GROUND, BREAST HEIGHT IS MEASURED ON THE UPHILL SIDE OF THE BOLE.
CANKER:	LOCALIZED INJURY TO STEM, BRANCH OR ROOT; CAUSED BY DISEASE OR INSECTS.
CANOPY:	THE COVER OF FOLIAGE FORMED BY TREE CROWNS.
CANOPY CLOSURE	THE PERCENTAGE OF GROUND AREA COVERED BY THE VERTICALLY PROJECTED CROSS-SECTIONS OF TREE CROWNS
CENSUS WATER:	PERMANENT AREAS OF WATER MORE THAN 4.5 ACRES OR WIDER THAN 200 FEET.
CERTIFICATION PLOT	A PLOT INSTALLED BY A CERTIFICATION CANDIDATE. IT MAY BE A TRAINING PLOT OR A PRODUCTION PLOT. THE CANDIDATE WORKING ALONE INSTALLS THE PLOT.
COLD VARIANCE	AN INSPECTION DONE EITHER AS PART OF THE TRAINING PROCESS, OR AS PART OF THE ONGOING QC PROGRAM. NORMALLY THE INSTALLATION CREW IS NOT PRESENT AT THE TIME OF INSPECTION. THE INSPECTOR HAS THE COMPLETED DATA IN-HAND AT THE TIME OF INSPECTION. THE INSPECTION CAN INCLUDE THE WHOLE PLOT OR A SUBSET OF THE PLOT. DATA ERRORS ARE CORRECTED. COLD VARIANCES ARE DONE ON PRODUCTION PLOTS ONLY.
CLINOMETER	AN INSTRUMENT USED TO MEASURE PER CENT SLOPE
CONDITION CLASS	CONDITION CLASS IS DEFINED BY DIFFERENCES IN CONDITION STATUS, OR IN ONE OF THE SIX MAPPING VARIABLES: RESERVED STATUS, FOREST COMMUNITY, OWNER GROUP, STAND SIZE, REGENERATION STATUS, AND TREE DENSITY.
CONIFER:	CONE-BEARING TREES, MOSTLY EVERGREENS, WITH NEEDLE OR SCALE-LIKE LEAVES BELONGING TO THE BOTANICAL GROUP GYMNOSPERMAE. ALSO REFERRED TO AS SOFTWOODS.
CONK:	THE FRUITING BODY OF A WOOD-DESTROYING FUNGUS WHICH PROJECTS FROM THE TRUNK, ROOTS OR OTHER TREE PARTS.

CROOK: ABRUPT BEND OR CURVATURE IN THE BOLE OF A TREE; A CROOK IS A SOUND CULL DEDUCTION FROM GROSS MERCHANTABLE VOLUME.

CROWN: THE PORTION OF A TREE CARRYING THE MAIN BRANCH SYSTEM AND FOLIAGE.

CROWN CLASS: THE SOCIAL POSITION OF A TREE RELATIVE TO ITS ABILITY TO RECEIVE DIRECT SUNLIGHT.

CROWN RATIO: THE PERCENT OF A TREE'S TOTAL HEIGHT WHICH HAS A LIVE CROWN.

CULL: (A) TREES OR LOGS, OR PORTIONS OF LOGS THAT ARE OF MERCHANTABLE SIZE BUT ARE UNUSABLE FOR INDUSTRIAL WOOD PRODUCTS DUE TO DEFECTS (ROT OR FORM). (B) TO CULL A LOG OR PORTION OF A LOG WITH RESPECT TO GROSS MERCHANTABLE VOLUME (C) THE DEDUCTION MADE FROM GROSS VOLUME OF A TREE OR LOG TO ADJUST FOR SOUND OR ROTTEN DEFECTS.

ROUGH CULL: PERCENTAGE DEDUCTION OF VOLUME LOST DUE TO BROKEN OR MISSING PARTS, FORKS OR CROOKS.

CULL ROT: LOSS OF GROSS MERCHANTABLE VOLUME DUE TO ROT. VISUALLY INDICATED BY CONKS, ROTTEN SEAMS, ETC., CODED AS A CATEGORY OF PERCENTAGE OF VOLUME AFFECTED BY THE ROT.

CULTURAL NONFOREST STRINGER: NONFOREST AREA OF CONSTRUCTED ROADS, RAILROADS, POWER-LINES, PIPELINES, AND CANALS WHICH ARE 1.0 ACRES OR LARGER WITH NO MINIMUM WIDTH REQUIREMENT.

CULTURALLY-KILLED TREE: A TREE TALLIED OR RECONSTRUCTED AS LIVE AT OC3 BUT SINCE KILLED BY DIRECT HUMAN ACTIVITY AND NOT UTILIZED. THE TREE CAN BE STANDING, DOWNED, OR FELLED. INCLUDED ARE TREES KILLED BY LOGGING INJURY AND STILL STANDING. A TREE IS CULTURALLY-KILLED ONLY IF IT SHOWS NO SIGN OF LIFE OR IS PARTIALLY UPROOTED , LIVE, AND LEANS $\geq$45 DEGREES.

D.B.H.: DIAMETER BREAST HEIGHT: THE TREE DIAMETER MEASURED AT BREAST HEIGHT--4.5 FEET ABOVE GROUND LEVEL.

DEAD TREE: A TREE TALLIED OR RECONSTRUCTED AS LIVE AT OC3 BUT NOW DEAD. DEATH WAS NATURAL AND NOT DUE TO DIRECT HUMAN ACTIVITY. A TREE IS DEAD ONLY IF IT SHOWS NO SIGH OF LIFE OR IS PARTIALLY UPROOTED, LIVE, AND LEANS $\geq$45 DEGREES.

DEFOLIATOR: AN INSECT, WHICH FEEDS UPON, OR STRIPS LEAVES AND NEEDLES FROM TREES.

DIAMETER	THE LENGTH OF A STRAIGHT LINE THROUGH THE CENTER OF AN OBJECT
DOMINANT TREE SPECIES	THE TREE SPECIES THAT IS THE MOST ABUNDANT AND NOT OVERTOPPED IN A CONDITION CLASS
EPIPHYTE:	A PLANT THAT USES A TREE FOR PHYSICAL SUPPORT, BUT WHICH DOES NOT DRAW NOURISHMENT FROM THE TREE
EVEN-AGED STAND:	A STAND IN WHICH INDIVIDUAL TREES ORIGINATED AT APPROXIMATELY THE SAME TIME. SPECIFICALLY, THE STAND MUST NOT BE CLASSIFIED AS NONSTOCKED, AND AT LEAST 70 PERCENT OF THE LIVE TREES PRESENT MUST BE WITHIN 30 YEARS OF ONE ANOTHER IN TOTAL AGE.
FIELD GRID LOCATION:	THE CENTER OF SUBPLOT 1 ON THE STANDARD PLOT LAYOUT. THE FIELD GRID LOCATION IS PINPRICKED ON PLOT PHOTOS IF THE PLOT WAS PREVIOUSLY VISITED; THIS INCLUDES ESTABLISHED PLOTS THAT CAN'T BE FOUND. THE FIELD GRID LOCATION IS PINPRICKED ON THE NEW PHOTOS FOR PLOTS THAT WERE NOT VISITED PREVIOUSLY.
FIXED-RADIUS PLOT:	A CIRCULAR SAMPLED AREA WITH A SPECIFIED RADIUS IN WHICH ALL TREES OF A GIVEN SIZE, SHRUBS, OR OTHER ITEMS ARE TALLIED.
FORB:	A BROAD-LEAVED HERBACEOUS PLANT AS DISTINGUISHED FROM GRASSES, SHRUBS AND TREES.
FOREST COMMUNITY:	CLASSIFICATION OF A FOREST SITE BASED ON THE TREE SPECIES PRESENT, PLANT COMMUNITY, AND OTHER SITE CHARACTERISTICS.
GLC:	GROUND LAND CLASS.
GROUND LAND CLASS:	A CLASSIFICATION OF LAND BY USE. THE MINIMUM AREA FOR CLASSIFICATION IS 1.0 ACRE. EACH MAPPED CONDITION CLASS REQUIRES A GROUND LAND CLASS.
HARDWOODS:	BROAD-LEAVED AND DECIDUOUS TREES AS OPPOSED TO HAVING NEEDLES. TREES BELONGING TO THE BOTANICAL GROUP ANGIOSPERMAE.
HARVESTED TREE:	A TREE TALLIED OR RECONSTRUCTED AS LIVE AND >5.O IN. D.B.H. AT A PREVIOUS INVENTORY, BUT SINCE HARVESTED FOR INDUSTRIAL SUPPLY, FIREWOOD, LOCAL USE, OR INCIDENTAL REASONS.

HEARTWOOD:	THE INNER, NONLIVING CORE OF WOOD IN A TREE BOLE, GENERALLY DARKER THAN SAPWOOD.
HECTARE:	A METRIC UNIT OF AREA EQUAL TO 10,000 SQUARE METERS. 2.47 ACRES.
HORIZONTAL DISTANCE	THE AMOUNT OF SEPARATION BETWEEN TWO POINTS THAT IS MEASURED AS IF BOTH POINTS ARE ON THE SAME PLANE; HORIZONTAL DISTANCE MUST BE CALCULATED FROM SLOPE DISTANCE IF THE 2 POINTS CANNOT BE MEASURED ALONG THE SAME PLANE
HOT VARIANCE	AN INSPECTION NORMALLY DONE AS PART OF THE TRAINING PROCESS. THE INSPECTOR IS PRESENT ON THE PLOT WITH THE TRAINEE AND PROVIDES IMMEDIATE FEEDBACK REGARDING DATA QUALITY. DATA ERRORS ARE CORRECTED. HOT VARIANCES CAN BE DONE ON TRAINING PLOTS OR PRODUCTION PLOTS.
IMPROVED PASTURE	LAND THAT IS CURRENTLY MAINTAINED AND USED FOR GRAZING. EVIDENCE OF MAINTENANCE, BESIDES THE DEGREE OF GRAZING, INCLUDES CONDITION OF FENCING, PRESENCE OF STOCK PONDS, PERIODIC BRUSH REMOVAL, SEEDING, IRRIGATION, OR MOWING.
INCLUSION	AN AREA THAT WOULD GENERALLY WOULD BE RECOGNIZED AS A SEPARATE CONDION, EXCEPTH THAT IT IS NOT LARGE ENOUGH TO QUALIFY. FOR EXAMPLE, A ½ ACRE POND WITHIN A FORESTED STAND.
INCREMENT:	THE INCREMENT IN D.B.H. OF A TREE IN A SPECIFIED PERIOD OF TIME.
INGROWTH TREE:	A TREE THAT HAS GROWN PAST A DIAMETER THRESHOLD ON A FIXED-RADIUS PLOT SINCE PREVIOUS INVENTORY.
INSPECTION CREW	A CREW OF QUALIFIED QC/QA INDIVIDUALS WHOSE PRIMARY RESPONSIBILITY IS THE TRAINING, CERTIFICATION AND INSPECTION OF PRODUCTION CREWS.
MAINTAINED ROAD	ANY ROAD, HARD TOPPED OR OTHER SURFACES, THAT IS PLOWED OR GRADED PERIODICALLY AND CAPABLE OF USE BY A LARGE VEHICLE. RIGHTS-OF-WAY THAT ARE CUT OR TREATED TO LIMIT HERBACEOUS GROWTH ARE INCLUDED IN THIS AREA.
MORTALITY TREE:	SEE DEAD TREE.
MQO	MEASUREMENT QUALITY OBJECTIVE – DESCRIBES THE ACCEPTABLE TOLERANCE FOR EACH DATA ELEMENT. MQOs CONSIST OF TWO PARTS: A STATEMENT OF THE TOLERANCE AND A

PERCENTAGE OF TIME WHEN THE COLLECTED DATA ARE REQUIRED TO BE WITHIN TOLERANCE.

MYCELIUM: THE VEGETATIVE PART OF A FUNGUS; A MASS OF THREAD-LIKE FILAMENTS.

NONFOREST INCLUSION: AN AREA THAT IS NONFOREST BUT LESS THAN 1.0 ACRE IN SIZE. WHEN PART OR ALL OF A FIXED OR VARIABLE-RADIUS PLOT FALLS WITHIN A NONFOREST INCLUSION, THE INCLUSION IS SAMPLED AS PART OF THE SURROUNDING FOREST LAND.

NONSTOCKABLE: A FOREST LAND CONDITION CLASS IS NONSTOCKED IF: 1) THE AVERAGE DIAMETER OF LIVE TREES IN THE CONDITION CLASS IS <5.O IN. D.B.H. AND <100 FREE-TO-GROW SEEDLINGS AND SAPLINGS PER ACRE ARE DISTRIBUTED BROADLY ACROSS THE CONDITION CLASS. OR: 2) THE AVERAGE DIAMETER OF LIVE TREES IN THE CONDITION CLASS IS ≥5.0 IN. D.B.H. AND TREE CANOPY COVER IS < 10 PERCENT. OR: 3) THE CONDITION CLASS WAS RECENTLY CLEARCUT AND HAS NOT BEEN REPLANTED.

PASTURE: PASTURE IS RANGELAND THAT HAS BE PLOWED AND ARTIFICIALLY SEEDED TO GRASS OR OTHER FORAGE SPECIES LIKE CLOVER TO FEED DOMESTIC LIVESTOCK. OFTEN, IT IS IRRIGATED AND FENCED.

PC: PLOT CENTER. THE FIELD GRID LOCATION ON THE GROUND FOR EACH FIELD PLOT. ON ESTABLISHED PLOTS VISITED AT OC3, PLOT CENTER IS AT THE OC3 CEDAR STAKE. ON MISSING OR LOST PLOTS, PLOT CENTER IS THE PINPRICKED LOCATION ON THE OC3 PLOT PHOTOS. ON NEW PLOTS, PLOT CENTER IS THE PINPRICKED LOCATION ON THE OC4 PLOT PHOTOS.

PI: PHOTO INTERPRETATION.

POLETIMBER: A TREE 5.0 TO 8.9 IN. D.B.H.

POLETIMBER STAND A STAND IN WHICH THE AVERAGE DIAMETER OF THE TREES PRESENT IS 5.0 TO 8.9 in. D.B.H.

PRODUCTION CREW A CREW CONTAINING AT LEAST ONE CERTIFIED INDIVIDUAL. THE CREW IS INVOLVED IN ROUTINE INSTALLATION OF PLOTS.

PRODUCTION PLOT A PLOT THAT BELONGS TO THE 6000-ACRE GRID DATABASE. IT MAY ALSO BE USED FOR TRAINING PURPOSES.

RANGELAND: LAND DOMINATED BY NATURAL PLANT COVER COMPOSED PRINCIPALLY OF NATIVE OR EXOTIC GRASSES, FORBS, OR SHRUBS. NATURAL RANGELAND IS UNIMPROVED, I.E., IT IS NOT IRRIGATED, AND HAS NOT BEEN SEEDED ARTIFICIALLY.

REGENERATION STATUS	A STAND DESCRIPTOR THAT INDICATES WHETHER A STAND HAS BEEN NATURALLY OR ARTIFICIALLY REGENERATED.
REGIONAL DRIFT	THE TENDENCY FOR STANDARDS, METHODS AND INTERPRETATIONS TO DRIFT APART OVER TIME AS EACH UNIT IMPLEMENTS THE FIA CORE PROTOCOL.
REGENERATION:	A YOUNG, PRECOMMERCIAL-SIZED STAND, OR THE UNDERSTORY TREE COMPONENT OF A MULTISTORIED STAND.
RELASKOP	AN INSTRUMENT USED TO ESTIMATE TREE DIAMETERS FROM A DISTANCE
RELEASE:	FREEING A TREE FROM IMMEDIATE COMPETITION BY REMOVING OTHER TREE OR NONTREE COMPETITION.
RESIDUAL OVERSTORY:	A TREE THAT HAS SURVIVED FROM THE PREVIOUS STAND AND IS USUALLY LARGER OR OLDER THAN TREES WHICH ORIGINATED AS PART OF THE PRESENT STAND.
ROT:	DECAY. DECOMPOSITION OF WOOD BY FUNGI OR BACTERIA.
ROUNDWOOD:	SECTIONS OF TREE STEMS, WITH OR WITHOUT BARK. INCLUDES LOGS, BOLTS, POSTS, PILINGS AND OTHER PRODUCTS STILL "IN THE ROUND".
RP:	REFERENCE POINT. AN OBJECT (USUALLY A TREE), WHICH CAN BE LOCATED ON THE GROUND AND IDENTIFIED ON THE PHOTO. IT WILL BE TAGGED AND REFERENCED TO THE CEDAR STAKE IN ORDER TO FACILITATE RELOCATING THE PLOT.
SAPLING:	A TREE 1.0 TO 4.9 IN. D.B.H.
SAPWOOD:	THE OUTER LAYERS OF WOOD BETWEEN THE HEARTWOOD AND INNER BARK. GENERALLY LIGHTER IN COLOR THAN HEARTWOOD.
SAWTIMBER STAND, SMALL	A STAND IN WHICH THE AVERAGE DIAMETER OF THE LIVE TREES PRESENT IS 9.0 TO 21.0 IN. D.B.H.
SAWTIMBER STAND, LARGE	A STAND IN WHICH THE AVERAGE DIAMETER OF THE LIVE TREES PRESENT IS GREATER THAN 21.0 IN. D.B.H.
SDI	STAND DENSITY INDEX.
SEEDLING:	A LIVE TREE LESS THAN 1.0 IN. D.B.H. THAT IS AT LEAST 0.5 FEET IN HEIGHT (CONIFERS) OR 1.0 FEET IN HEIGHT (HARDWOODS) AND ESTABLISHED IN MINERAL SOIL.

SEEDLING-SAPLING STAND A STAND IN WHICH THE AVERAGE DIAMETER OF THE LIVE TREES PRESENT IS LESS THAN 5.O IN. D.B.H.

SILVICULTURE: THE SCIENCE AND PRACTICE OF GROWING AND TENDING FOREST CROPS FOR SPECIFIED OBJECTIVES.

SITE: THE AGGREGATE OF ALL ENVIRONMENTAL CONDITIONS AFFECTING THE SURVIVAL AND GROWTH OF A PLANT COMMUNITY ON A SPECIFIC AREA.

SITE CLASS: A CLASSIFICATION OF POTENTIAL AVERAGE ANNUAL ABILITY OF A FOREST LAND SITE TO PRODUCE WOOD--FOR THE PERIOD BETWEEN THE TIME OF STAND ESTABLISHMENT AND THE TIME WHEN AVERAGE ANNUAL WOOD PRODUCTION PEAKS-- WERE THE SITE FULLY STOCKED WITH DESIRABLE TREES.

SITE INDEX: A MEASURE OF PRODUCTIVITY INHERENT ON A FOREST SITE THAT IS SIMPLE NUMERICAL VALUE BASED UPON TREE HEIGHT AT A SPECIFIED AGE.

SLOPE DISTANCE THE AMOUNT OF SEPARATION BETWEEN 2 POINTS AS MEASURED ALONG AN INCLINE. SLOPE DISTANCE = HORIZONTAL DISTANCE WHEN THE % SLOPE BETWEEN THE 2 POINTS IS ZERO. WHEN MEASURING SLOPE DISTANCE FOR REFERENCE TREES, SLOPE DISTANCE IS MEASURED FROM THE HEAD OF THE NAIL AT THE BASE OF THE TREE TO SUBPLOT CENTER

SNAG: A STANDING DEAD TREE. IN THE CURRENT INVENTORY, A SNAG MUST BE $\geq$5.O IN. DBH AND $\geq$4.5 FEET TALL, AND HAVE A BOLE WHICH DOES NOT TOUCH THE GROUND. A SNAG MAY BE EITHER SELF-SUPPORTED BY ITS ROOTS, OR SUPPORTED BY ANOTHER TREE OR SNAG.

SOFTWOODS: CONIFEROUS TREES, USUALLY EVERGREEN, HAVING NEEDLE OR SCALE-LIKE LEAVES.

STAND AGE: THE TOTAL AGE OF A FOREST STAND THAT BEST CHARACTERIZED THE STAND. STANDS ARE EVEN- OR UNEVEN-AGED.

STANDING DEAD TREE: SEE SNAG.

STAND DENSITY INDEX: THE MAXIMUM NUMBER OF TREES PER UNIT AREA A FOREST SITE WILL SUPPORT WHEN THE STAND D.B.H. IS 10 INCHES RELATIVE TO THE MAXIMUM EXPECTED NUMBER IF THE SITE WERE CAPABLE OF SUPPORTING A NORMAL STAND.

STAND SIZE:	A CLASSIFICATION OF STANDS BASED ON TREE SIZE. STAND SIZES ARE LARGE SAWTIMBER, SMALL SAWTIMBER, POLETIMBER, AND SEEDLING-SAPLING STANDS. IF LESS THAN 10 PERCENT STOCKED WITH LIVE TREES, THE SITE IS CALLED NONSTOCKED.
STOCKING:	A QUALITATIVE EXPRESSION BASED ON COMPARING THE EXISTING NUMBER OF TREES PRESENT ON A FOREST SITE TO THE NUMBER NEEDED TO ACHIEVE THE MOST OPTIMAL GROWTH, VOLUME, OR VALUE POSSIBLE ON THE SITE.
SUNSCALD:	DAMAGE TO THE CAMBIUM CAUSED BY OVEREXPOSURE TO SUN.
SWEEP:	A BROAD ARC IN A BOLE OR LOG. A SOUND CULL DEFECT.
TALLY TREE	A TREE, SAPLING, OR SEEDLING THAT IS SELECTED TO BE MEASURED ACCORDING TO THE RULES IN THIS MANUAL.
TERMINAL LEADER:	THE TOPMOST SHOOT OF A TREE.
TRACHEID:	PART OF WOOD STRUCTURE: A LONG, TUBELIKE CELL IN WOOD TISSUE.
TRACKABLE TREE:	A SAMPLED TREE THAT IS REFERENCED AND REMEASURED IN SUCCESSIVE INVENTORIES ON PERMANENT PLOTS.
TRAINING PLOT	A PLOT ESTABLISHED FOR TRAINING OR CERTIFICATION PURPOSES ONLY. IT DOES NOT BELONG TO THE 6000-ACRE GRID DATABASE.
TREE	A TREE IS A WOODY PLANT THAT HAS AN ERECT PERENNIAL STEM OR TRUNK AT MATURITY THAT IS AT LEAST 3.0 IN. DIAMETER AT BREAST HEIGHT (4.5 FEET) AND A TOTAL HEIGHT OF AT LEAST 12 FEET. (Ag. Handbook No. 541, 1979, ed., p. 3).
UNEVEN-AGED STAND:	A STAND THAT IS NOT CLASSIFIED AS NONSTOCKED AND THAT HAS LESS THAN 70 PERCENT OF THE TREES PRESENT WITHIN 30 YEARS OF ONE ANOTHER IN TOTAL AGE.
WILT:	DROOPING OF FOLIAGE; OFTEN A DISEASE SYMPTOM.

APPENDIX 19 – SUMMARY OF MAJOR MANUAL CHANGES FROM 2011

2011 to 2012 Hawaii Manual (2011 item numbers marked with *)		
Location		**Change**
General		
	Entire Manual	Updated from version 5.0 to 5.1 of the National Core Field Guide
	Entire Manual	Removed all references to the macroplot, macroplot dimensions, and large trees on the macroplot
Chapter 1: Introduction		
	1.1 General Description	Replaced plot layout diagram (subplot only, no macroplot)
Chapter 2: Travel Planning and Locating the Plot		
	2A Landowner Contact	Changed contact information to Ray Koleser instead of Robert Pattison
Chapter 3: Plot Layout and Referencing		
	3A Plot layout at the current annual inventory	Replaced plot layout diagram (subplot only, no macroplot)
	3A Plot layout at the current annual inventory	Replaced navigation table to be same as AK
Chapter 4: Plot Level Data		
	4.9* Macroplot Breakpoint Diameter	Deleted data item
	4.17 Plot Nonsampled Reason	Removed code 11 – Ocean
	4.21 Sample Method Code	Added data item
	4.34 GPS Coordinates	Changed GPS Location Types “11, 12, 13, or 14” to “15, 16, 17, or 18” for each Survey Grade GPS data item both in the description and for “when collected”
Chapter 5: Condition Class Data		
	5.9* Nonforest Condition Nonsampled Reason	Moved to 5.5.5 Nonforest Condition Nonsampled Reason
	5.5.6 Nonforest Condition Class Sampling Status	Added data item
	5.7.1 Owner Class	Changed Code 46 – Village or communal property to code 34
	5.7.2 Private Owner Industrial Status	Changed language for data item reflecting that it will be auto-populated as ‘0’ in Hawaii
	5.7.8 Disturbance 1	Removed Code 55 – earth movement/avalanches
	5.7.29 Total Stems	Added When Collected language “…AND CANOPY COVER SAMPLE METHOD > 1”
Chapter 8: Vegetation Profile/Invasives		
	8.2 General Definitions	Updated NRCS codes from 2000 to 2010
	8.5.2 Species Code	Updated NRCS codes from 2000 to 2010
	8.5.10 Vegetation Specimen Label Community Description	Added data item
	8.12 Species Code	Updated NRCS codes from 2000 to 2010
	8.12 Species Code	Invasive species list has been updated to include additional species and 2010 NRCS codes
Chapter 10: Tree and Sapling Data		
	10.0 Tree and Sapling Data	Changed “base of the tree” to “top of the root collar”
	10.9 Standing Dead	Changed “base of the tree” to “top of the root collar”
	10.10 Lean Angle Code	Changed “base” to “top of root collar”
	10.13 Azimuth	Changed “base of each tree” to “pith at top of root collar”

	10.16.1 Previous Diameter at Breast Height	Changed field width from 5 to 4 digits
	10.16.2 Diameter at Breast Height	Changed field width from 5 to 4 digits
	10.16.2 Diameter at Breast Height	Added 13. For trees with prop roots (e.g. pandanas)
	10.16.4 Length to Diameter Measurement Point	Changed “above the ground” to “from the top of the root collar”
	10.16.4 Length to Diameter Measurement Point	Changed values from 00.1-15.0 to 00.1-30.0
	10.16.5* Second Diameter on Upper Bole	Deleted data item
	10.16.6* Length to Second Diameter	Deleted data item
	10.16.5 Length to Centroid Diameter	Added data item
	10.16.6 Actual Length to Centroid Diameter	Added data item
	10.16.7 Centroid Diameter on Upper Bole	Added data item
	10.17 Branching Characteristics	Added diagram and value of 0 for “No branches present, only coded when Standing Dead = 1”
Appendices		
	All Appendices	Updated Appendix numbers as needed
	Appendix 1 Tree Species List	Dropped tree species 6926, 6927, 7712, 7713, 7714, 8672, and 8673
	Appendix 1 Tree Species List	Removed NRCS 2000 column (This will require an update to NRCS 2010 in the 2013 Pacific Islands manual, not completed for 2012 due to time constraints)
	Appendix 6 Haglöf Vertex III User Guide	Added appendix
	Appendix 8 Criterion RD 1000 User Guide	Added appendix
	Appendix 13 Example of Banyan Tree Measurements	Updated “height to DBH” in diagram
	Appendix 15 Landowner Contact Letter	Updated dates and contact information
	Appendix 16 Hello Letter/Data Confidentiality	Updated dates and contact information

APPENDIX 20 – BLANK PAGES FOR NOTES

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